Aurora Sporealis

The alumni news magazine of the Department of Plant Pathology **2015 Edition**

USING MICROBES TO CREATE HEALTHIER PLANTS

Plant Pathology research is finding ways to harness microbes indigenous to Minnesota's native prairies by using them to create disease suppressive soils.

Also inside:

Students talk about their path to Plant Pathology and how they became interested in solving plant health and disease issues

Department of Plant Pathology

University of Minnesota

Driven to Discover℠

Aurora Sporealis

The *Aurora Sporealis* is the alumni news magazine of the Department of Plant Pathology at the University of MInnesota. All volumes are bound and are available in Borlaug Hall on the St. Paul Campus, Room 495 or online: http://z.umn.edu/aurorasporealis

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Letter from Department Head

2015 has been a busy and very productive year for the Department of Plant Pathology. Our faculty, staff, and students continue our long tradition of improving and safeguarding plant health here at home and around the globe.

The *Aurora Sporealis* has a new look and this edition provides comprehensive review of the many accomplishments of our students, staff, and faculty. But I just have to mention a few highlights that make me proud to be part of this Department. In 2015, we celebrated with **Carol Ishimaru,** named Fellow of the American Phytopathological Society, congratulated **Zane Grabau, Anna Yang, Nick Lelanc, Josh Kielsmeier-Cook** and **Peng Zhou** on completion of their graduate degrees, and welcomed several new staff members and graduate students from around the world. **Brett Arenz** has worked this year to develop the Department's first, completely online course. PLPA 2003 "Plague, Famine, and Beer" tells the story of how microbes have impacted human health (plague), food security (famine), and human happiness (beer). The online version will be taught for the first time in 2016. We've also launched an aggressive new communications strategy to highlight the impact of our students, staff, and faculty and to raise visibility of our Department inside and outside of the University. We've also updated meeting rooms and offices, and we are now planning a spruced up and reimagined Plant Pathology Library that will provide our Department with a dynamic new space for student study, collaborative research, and public engagement. These are just a few of the many exciting stories you'll read about in this edition.

You might recall that last year we announced the launch of the Stakman-Borlaug Center (SBC) for Sustainable Plant Health. The SBC supports interdisciplinary research and outreach efforts to solve plant health challenges that impact global food security and ecosystem health. As plant pathologists, we understand the value of interdisciplinary research and the SBC positions the Department of Plant Pathology as the interdisciplinary problem-solving leader in the plant sciences at the University of Minnesota. The SBC has been a success, currently boasting 65 members from 10 distinct disciplines and helping our faculty compete successfully for research funding to solve plant health challenges. **Karen Hokanson** continues to provide strong leadership of the SBC as Managing Director. In 2015, we defined three research and outreach portfolios for the SBC: Global Sustainable Crop Production, Plant Genetic Resources, and the Plant Health for Pollinator Health Initiative. The SBC has brought increased visibility to UMN plant sciences, increased institutional competitiveness for research funding, and created new outreach and student training opportunities. As I write this, I look forward to the SBC's fall symposium on December 10. The "Sustainable Crop Production Research and Outreach in Africa" symposium will connect UMN researchers already working in Africa with funding agencies and industry including the Rockefeller Foundation and Land O'Lakes, highlight efforts to establish UMN research partnership hubs in Morocco and South Africa, and provide opportunities for future collaborations and grant writing. The SBC has already brought significant institutional support to the Department (and plant sciences more broadly), and we expect further growth in 2016, including the launch of an outreach effort focused on the impacts of plant health management on pollinator health.


Jim Bradeen, Department Head

2015 has been an excellent year for our Department in many ways. Yet we still face challenges. Despite improved financial conditions in the state of Minnesota, budget cuts and reallocations at the College and institutional levels continue to negatively impact our Department. I worry about the cost of graduate education, abysmally low success rates for federal research grants, and long term financial stability of essential Departmental facilities like the Plant Disease Clinic. These are issues we continue to work on together. For example, we are building relationships with industry partners to fund graduate education and research. We are working with funding agencies like the USDA's Foundation for Food and Agricultural Research to ensure support for plant health research. We are advocating for increased research support from University leadership. And our new communications efforts are designed to ensure that College and institutional leaders understand the impact and importance of Plant Pathology.

A bright spot in our financial future continues to be support from alumni and friends. I am truly grateful for the generosity of our donors and volunteers who support the Department's research, teaching, extension, and outreach mission, who advocate for the Department with University leadership, and who promote the activities of the Department to the broader community. Your energy, passion, and financial support help us to continue our long history of excellence and to address new plant health opportunities and challenges. Thank you for all you do!

Wishing you all the best,

Jim Bradeen

Using Microbes to Create Healthier Plants

Linda Kinkel and her research team are trying to find ways to harness microbes indigenous to Minnesota's native prairies by using them to create disease suppressive soils.

Minnesota's native prairies are composed of a thriving community of perennial herbaceous plants, despite the presence of diverse plant pathogens. By trying to disentangle the reasons why these plants have been able evade significant disease in the prairie, are there important lessons that can be applied to agriculture to create healthier, more productive plants?

Plant Pathology professor **Linda Kinkel** and her research team are evaluating a genus of soil bacteria found in native prairie systems, *Streptomyces*, vital in the fight against plant pathogens. These bacteria, which are found naturally within the soil, are effective in suppressing plant pathogens since they produce antibiotic compounds when competing for food in highly competitive soils. These bacteria are key in the fight against pathogens since most plant pathogens are susceptible to at least one of the many compounds produced by Streptomyces. There are multiple different ways these diverse compounds inhibit pathogens, such as killing the pathogen, keeping it from growing, or preventing pathogen spores from germinating.

Kinkel and her team are investigating ways that growers can manage indigenous populations of microbes to increase their abilities to produce diverse compounds that can suppress plant pathogens and enhance plant growth.

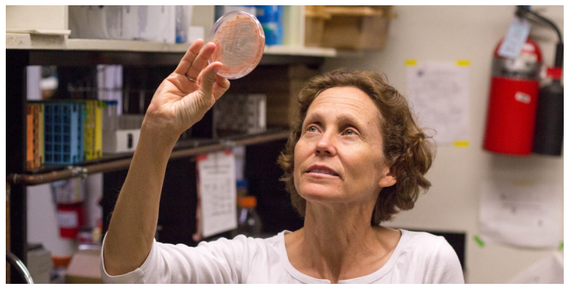
"Everything that a grower does to the soil influences the microbial community. The scientific community does not yet have a refined understanding about how all these management practices can influence this community," says Kinkel.

One goal of this project is to increase understanding of how the complex microbial community interacts to improve plant productivity so as to provide a robust foundation for understanding the impacts of agronomic practices on soil communities, and in doing so help harness the benefits of the indigenous microbial community to make agricultural crops more productive and to promote ecosystem health.

"We want to propose really specific and deliberate ways that growers can enhance the good guys. An outcome of that we hope will be reductions in the use of pesticides and fumigation, and the capacity to produce healthier crops with higher yields."

"We want to propose really specific and deliberate ways that growers can enhance the good guys."

Streptomyces is a genus of gram-positive bacteria and its many species are highly diverse. View the colorful diversity of these highly-useful and truly beautiful bacteria at: https://www.facebook.com/umnplantpathology/videos/



Helping Minnesota Hops Grow

On-site research trials with growers provide fertility and disease management information that helps the Minnesota hops industry grow.

As the microbrewery industry in the state of Minnesota continues to expand each year, brewers are looking to hop producers near home to provide sustainable and high-quality hops. In order to meet this growing demand, **Angela Orshinsky**, assistant professor in the Department of Plant Pathology, and her research team are working with hop producers throughout the state to provide answers to the many hops management questions that past research has not yet answered for local producers.

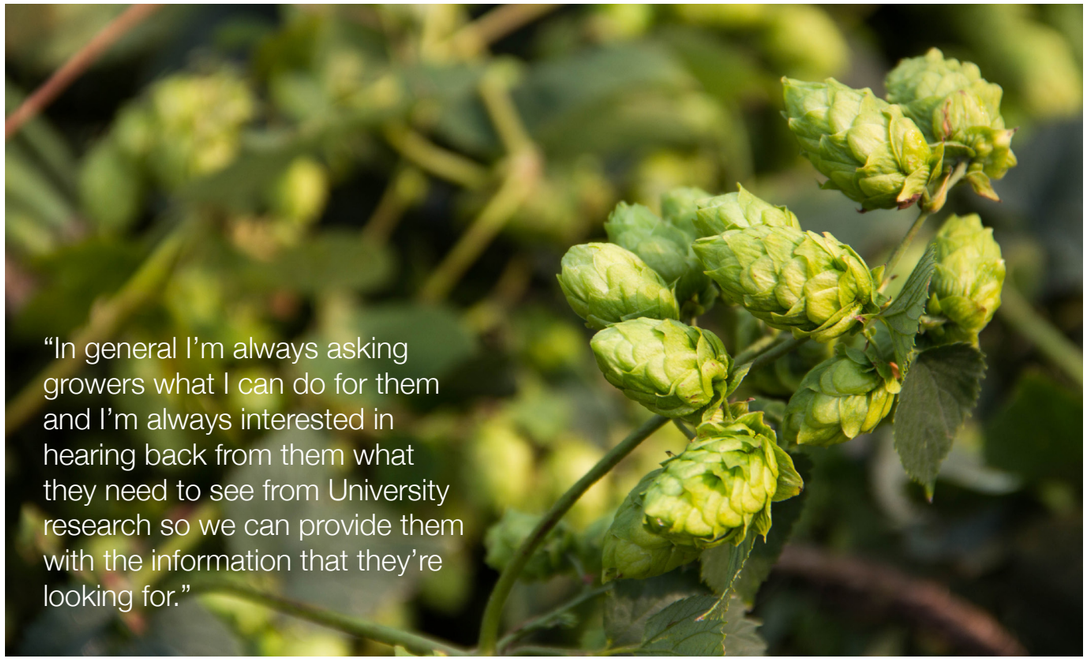
"There are a lot of unanswered questions with hops in Minnesota and other areas in the Midwest where hops have not been traditionally grown," says Eric Sannerud CEO of Mighty Axe Hops, a hops growing farm in Ham Lake, MN started by Sannerud and fellow CFANS alumnus Ben Boo. Mighty Axe Hops is one of the many locations in Minnesota where Orshinsky's team is conducting on-site research trials in order to provide growers the research-based information they need to successfully grow local hops.

"There's an ever present gap in knowledge of how to grow hops in areas where they have not been traditionally grown," says **Josh Havill, M.S. student** whose research project focuses on hop disease diagnosis and management.

This gap exists since traditionally hops production has been highest in the Pacific Northwest as well as in areas of Michigan. In fact, hops have not been grown on a commercial scale in Minnesota since the early 1900's when both hop downy mildew and Prohibition forced a halt in production. As a result of this growers have been left primarily with management recommendations based on data collected from a drastically different growing environment. By carrying out on-site research trials, Orshinsky's team can provide region-specific management recommendations, so growers can make the best decisions for their operation.

"The benefits of doing on-site grower trials is that this is a real-world condition. This is not something you set up in an isolated spot or in a greenhouse. The growers get to go out and see how they can implement agronomic practices to properly manage their hops," says Orshinsky.

Hops plants can grow anywhere from 12 to 20 feet in a span of about three months during the Minnesota growing season. As a result of this, the plants require a lot of care and a proper fertilization regimen in order to maintain proper growth. One portion of Orshinsky's research project focuses on nitrogen fertilizer amendments and how the timing of those



applications affect yield, cone quality, and alpha acid content.

“This project in particular was the result of my impression that we really don’t have any nitrogen recommendations for growing hops in Minnesota,” says Orshinsky.

The project focuses on evaluating conventional and organic nitrogen fertilizers options, and when are the most effective times for growers to be applying these fertilizers. Fertilizer sources are also being assessed to see if they influence disease progression, since anecdotal evidence has shown that fertility sources may influence the diseases present in hop yards.

Throughout the Midwest, many hops diseases are prevalent because of the amount of rain occurring each year, and cold winters promote diseases such as downy mildew (*Pseudoperonospora humuli*). Growers are constantly battling with diseases that can devastate yields and the overall quality of the cones.

“Disease management throughout the season that’s just what you have to do. What we’ve created behind me is an enormous perennial monoculture, so all of the diseases that like hops are starting to figure out that we have hops here,” says Sannerud.

Orshinsky’s team is working with growers to educate them on how to identify and manage the diseases they face in their yards effectively and sustainably through various agronomic practices. One of the long-term goals of this project is to also develop hops varieties that are resistant to disease, and currently the team is assessing wild hop varieties to see if there is resistance to downy mildew, the state’s most prevalent disease.

“Developing these cultivars would be a great contribution to the reduction of disease, especially in a sustainable system where you’re trying to reduce fungicide inputs,” says Orshinsky.

Moving forward Orshinsky’s team hopes to provide a solid foundation of information for hops growers as the industry continues to grow and evolve throughout the state. In order to do this, the research relies heavily on the collaboration between the hops community and University of Minnesota research.

“In general I’m always asking growers what I can do for them and I’m always interested in hearing back from them what they need to see from University research so we can provide them with the information that they’re looking for,” says Orshinsky. The research will continue to search for answers to the questions that current research does not yet speak to in order to help provide growers the necessary skills to be able to grow hops in an environmentally sustainable and profitable manner.

“The hops industry has a lot of room to grow and a critical support for that industry getting to where we need it to be is University research,” says Sannerud.

Classifying Fungal Diversity in Ecuador

Graduate Student Josh Kielsmeier-Cook has the opportunity to explore Yasuní National Park in Ecuador to classify the vast diversity within *Xylaria*, fungi that could prove useful in pharmaceuticals and bioenergy production.

Photos by Josh Kielsmeier-Cook

Trying to find a needle in a haystack can seem like an insurmountable task, but imagine attempting to find 100 needles in 100 haystacks. This is a more apt description of the task that faces **Josh Kielsmeier-Cook.** Josh, a PhD student in the Department of Plant Pathology advised by Bob Blanchette, is currently studying fungi in Yasuní National Park in Ecuador, where there are not only 100 needles, but 100 unique needles that need to be classified and cataloged.

The region of the Amazon Rainforest where Josh is conducting his research is one of the most biodiverse locations on Earth. One hectare, or almost 2.5 acres, in Yasuní contains more species of trees than in all of North America. In addition to thousands of tree species, there are also thousands of species of insects and, most importantly for Josh, thousands of different fungi. “Yasuní is an incredibly beautiful and diverse place, it is pretty magical,” says Josh.

Unfortunately, this area of vast diversity is under threat, as oil drilling is rapidly developing in parts of this UNESCO designated biosphere reserve. For Josh, the race is on to classify the diversity and better understand the ecology of one particular fungal genus, *Xylaria*, which may be useful in pharmaceuticals and bioenergy production.

> "The race is on to classify the diversity and better understand the ecology of one particular fungal genus, Xylaria, which may be useful in pharmaceuticals and bioenergy production."

The genus *Xylaria* is a group of fungi that has great genetic diversity, and "in this particular location [the *Xylaria*] are hyper-diverse." Josh goes on to explain there are almost 700 named species of *Xylaria* some of which may be duplicates and represent multiple species. The last known published treatment of these fungi was in the late 1950s by a British mycologist, R. W. G. Dennis. Previously, *Xylaria* was classified by more subjective criteria such as physical characteristics.

Josh's research, which relies on close collaboration with CFANS Plant Pathology alumni Charles Barnes and Maria Ordoñez (Universidad de las Américas Quito and Pontificia Universidad Católica del Ecuador, respectively), involves sampling the fruiting bodies of *Xylaria* by extracting DNA to sequence a specific region of the fungi's genome. This is the beginning of a process to gather genetic data, which can be used much like retailers use a barcode to look up specific products. The genetic data that is gathered from this process is compared to previously published reference sequences in order to discover which of these reference sequences the specimen most closely matches. This data will then provide a more accurate picture of the *Xylaria* found in Yasuní, as opposed to older methods of classification, which relied merely on physical characteristics of the fungi to place them into classification groups.

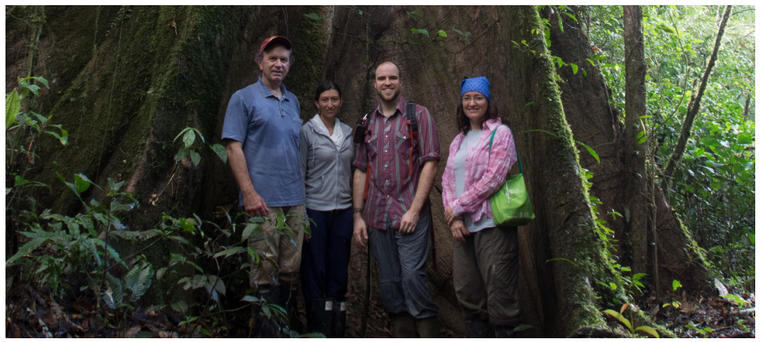
The classification of the *Xylaria* genus comes as a byproduct of a larger goal to better understand how the diversity of *Xylaria* impacts the ecology of this rainforest. Josh's preliminary findings have revealed that *Xylaria* have many different complex and diverse ecological roles or lifestyles. While *Xylaria* primarily occupy a saprobic lifestyle in Yasuní, decaying dead plant matter, evidence suggests that they may also be endophytic, living within host plants, potentially enhancing growth and the plant's ability to tolerate particular stresses.

Ultimately through his research, Josh hopes to learn more about the relationship between the genetic variation within this one genus and the possible link between the saprobic and endophytic lifestyles. The answers to these questions may shed light on other important uses for *Xylaria* as well as help explain the potential impact these fungi can have on medicine and bioenergy production. Josh plans to continue his investigation of these questions on future trips back to Yasuní with the aid of departmental fellowships and external awards.

These past and current awards have, as Josh states, "given me the great opportunity to explore this fascinating ecosystem in Ecuador and Yasuní National Park."

Top & next page: Various fungal specimens found within the genus Xylaria in the Ecuadorian Rainforest

Bottom: Robert Blanchette Plant Pathology Professor and Kielsmeier-Cook's advisor, Cristina Toapanta Albán Ecuadorian Student, Kielsmeier-Cook, and Maria Ordonez, a Plant Pathology Alumna, in Yasuni National Park in Ecuador.



View the Diversity of *Xylaria*

View the photos taken by Josh Kielsmeier-Cook in the Amazon Rainforest in Ecuador capturing the beauty and diversity of the genus Xylaria: https://www.flickr.com/photos/plpathmn/sets/72157652653910630/with/17647271479/

Evaluating a Reemerging Threat to Corn

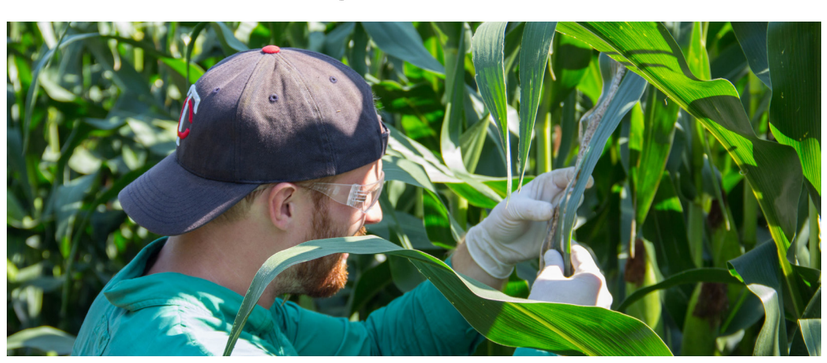
Goss's wilt, a reemerging threat to corn yields, is appearing in fields across Minnesota and the northern corn growing region. First confirmed in Minnesota in 2009, this disease is a concern for researchers like graduate student **Blake Webster** because of its potential to reduce corn yields by as much as 50 percent. While there are currently recommendations for disease control measures, Webster is taking a holistic, three-pronged approach to learn more about this disease and discover additional methods of disease management.

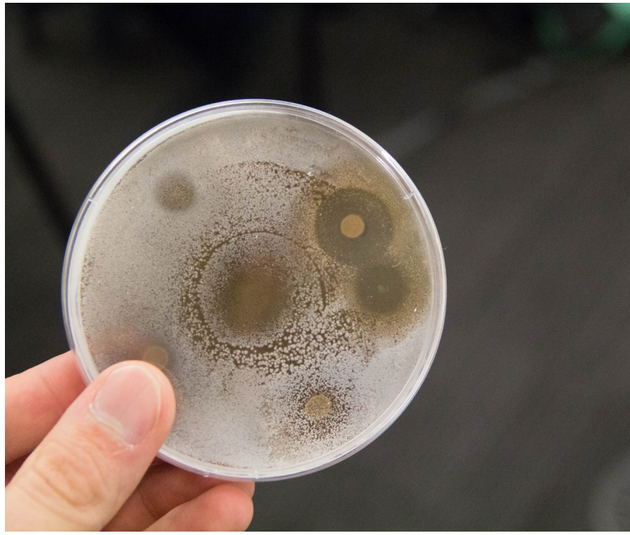
Under the guidance of advisor **Dean Malvick**, Webster is analyzing the genetic diversity of the bacterial pathogen (*Clavibacter michiganensis* subsp. *nebraskensis*) that causes the disease. This research however, may actually reveal that different isolates of the pathogen have different resistance needs," says Webster, adding that currently no corn hybrids are completely resistant to Goss's wilt. Having a snapshot of the pathogen's genetic profile will help breeders create hybrids that are widely resistant to the pathogen.

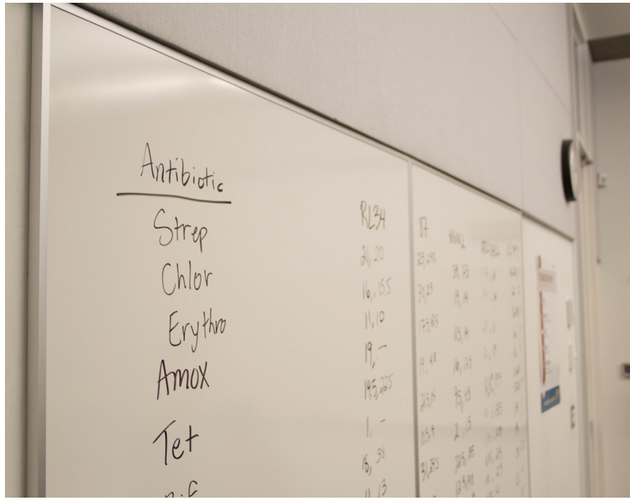
Webster's second research objective is investigating whether methods that growers are using to manage other plant diseases are creating more favorable conditions for Goss's wilt. Webster is assessing how Goss's wilt progresses when exposed to different agrochemicals. Generating this data will help provide appropriate management strategies for growers seeking to effectively control all plant diseases their fields may face.

Preventing the Goss's wilt pathogen from infecting corn is just one piece of the control puzzle since the same pathogen may infect other plant species as well. Webster is conducting a host range study to see if plant species commonly associated with corn can host the bacteria year after year. "If these species are serving as an inoculum source for the pathogen, growers would need to be effectively controlling these plants in order to prevent the disease from subsequently infecting corn," says Webster.

Ultimately Webster and his research team aim to provide research-based information to help growers make informed, sustainable disease management decisions. "We're looking for control measures but they also have to be environmentally friendly, cost-effective and reasonable for growers to adopt. If the research we are doing contributes to finding control mechanisms that allow all of those facets to be fulfilled we will be happy."







Creatively Discovering Science Through Antibiotics

How a Plant Pathology course focusing on antibiotics teaches students to think creatively about science.

Science is not only knowledge, but is an ongoing activity where the application of this knowledge can help explain nature in a reproducible way.

This sentiment uttered by professor **Linda Kinkel** at the beginning of the Plant Pathology freshman seminar course “Antibiotics: Promise, Profits, and Pitfalls” set a precedent for a day of hands-on laboratory exercises where undergraduate students spent the day applying the teachings of Kinkel and fellow professor **Carol Ishimaru** on the scientific method by evaluating various antibiotics and learning about pharmaceutical drug discovery. The seminar focuses on providing a holistic perspective of antibiotics for undergraduates across the University with topics ranging from antibiotics in the natural world, drug development and patent law, and media perceptions of antibiotics, in order to help the next generation of students develop scientific literacy and critical thinking skills.

The topic of the day’s lecture focused on how science always starts with making informed observations of the natural world, so undergraduates evaluated how various antibiotics, as produced by microbes, effectively protect against pathogens. Using this data students were then asked to formulate a hypothesis about which microbial isolates they might chose if they were a member of a drug discovery unit for a major pharmaceutical company. When looking to answer this question students analyzed their data to see how an antibiotic’s spectrum of activity might influence their decision, and what other questions would need to be answered, such as cost of development and levels of toxicity present in the antibiotic, before the drug should be developed.

Not only were students asked to critically think about science, but also encouraged to implement creativity into science. “The starting point for doing science is your idea,” said Kinkel. With continued development of courses like this, the Department of Plant Pathology hopes to get students to discover science creatively.

Reducing the Global Threat of Wheat Stem Rust

How the Department of Plant Pathology and the Stakman-Borlaug Center for Sustainable Plant Health are providing sustainable solutions to one of the world's most devastating diseases.

Wheat is among the world's most important staple food crops and rust is one of the crop's most devastating diseases.

With support from USAID, CIMMYT, and the Cornell Durable Rust Resistance of Wheat project, scientists are studying the biology and control of new, dangerous forms of wheat rust that have emerged in East Africa and other parts of the world. Emphasis is on highly virulent East African rust races capable of destroying 80% of the world's wheat crop.

Wheat cultivar 'Digalu' has been the most widely grown cultivar in Ethiopia over the last several years. Digalu was selected by farmers because of its resistance to stripe rust and to the Ug99 lineage stem rust race TTKSK. However, in 2013, an epidemic of wheat stem rust occurred in Ethiopia, which caused significant yield losses especially on Digalu. Researchers from the USDA Cereal Disease Lab and the University of Minnesota Department of Plant Pathology, working with an international team, found that the stem rust epidemic was caused by a new race of wheat stem rust called TKTTF that is not related to the Ug99 lineage of races.

In response to the race TKTTF epidemics in Ethiopia that occurred again in 2014, UMN/USDA researchers facilitated the deployment of five new stem rust nurseries in Ethiopia. The purpose of these nurseries is to evaluate wheat lines with important races of the stem rust pathogen. These single-race nurseries have been used to identify wheat cultivars and breeding lines that possess resistance to the four most common, virulent races of the stem rust pathogen in Ethiopia. Data from these nurseries, established in 2014, identified that cultivar 'Kingbird' is resistant to all of the stem rust races. Kingbird was subsequently released as a variety in Ethiopia by the Ethiopian Institute of Agricultural Research (EIAR) in May 2015.

The Stakman Borlaug Center (SBC) plays a critical role in facilitating this collaborative research. The SBC facilitates the international collaboration of UMN, USDA, EIAR, and CIMMYT researchers through support for the training of EIAR technicians by sending scientists, including **Drs. Ruth Dill-Macky** and **Pablo Olivera**, to Ethiopia to participate in training workshops there. The SBC also plans to support

Top Left: Yue Jin with EIAR collaborators February 2015

Top Right: Attendees of the week long training on wheat diseases held at the Kulumsa Agricultural Research Center, Ethiopia this October.

Bottom Right: Stem rust single-race nursery at Kulumsa, Ethiopia 2014

training courses on rust phenotyping for Ethiopian scientists here on the St. Paul Campus. SBC has facilitated a 6-week rust-phenotyping course here in the past for researchers from other countries, taught by UMN/USDA scientist Pablo Olivera, where participants can gain hands-on experience identifying wheat rust phenotypes.

In February 2015, the SBC hosted a crucial USAID Ethiopia-rust project launch meeting for the 'Rust Surveillance and Warning' component of the project. This meeting, jointly organized by USDA and CIMMYT, brought together collaborators from the USDA and UMN, EIAR, CIMMYT, Cornell and USAID for five days of planning for the technical and logistical details of the project. Twenty-four people attended this meeting, including participants from Minnesota, Ethiopia, Kenya, Mexico, and Washington, DC. In addition to the intensive planning sessions, the participants delivered seminars to the UMN community, spent time observing rusts in the greenhouse, visited a local wheat field where they met with the farmer and UMN extension agents, and visited the Mill City Museum in Minneapolis. The EIAR Director General, Dr. Fentahun Mengistu, and the Director of the Crop Research Directorate, Dr. Asnake Fikre, were honored guests at the meeting, and SBC also facilitated a series of meetings for them with a number of CFANS administrators, faculty, and staff.

The Stakman-Borlaug Center for Sustainable Plant Health

The SBC builds upon the vision of University of Minnesota scientists Elvin C. Stakman and Norman E. Borlaug, applying interdisciplinary approaches to solve plant health problems that impact global food security and ecosystem health.

Visit the Webpage: sbc.umn.edu

My Plant Path:
The Path to Plant Pathology

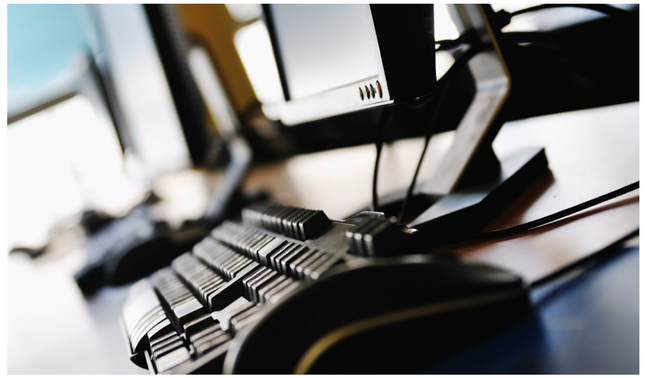
Plant pathology is a diverse and interdisciplinary science that integrates knowledge across scientific disciplines. Our staff, student, and faculty members are as diverse as the science itself, but how did they becoming interested in solving plant health and disease issues? Find out how an interest in science often leads to a passion for plant pathology by watching the videos at: https://plpa.cfans.umn.edu/about-plant-path/my-plant-path

As a former Horticultural Science undergraduate student at the University of Minnesota, **Marissa Scherven**'s path to Plant Pathology began when she got involved with Dr. Jim Kurle's lab, conducting research on diseases of soybeans. As a result of this experience, Marissa hopes to pursue her graduate degree in plant pathology.

Originally wanting to be a doctor as an undergraduate, **Andrew Sathoff**'s interest in plant physiology and disease eventually led him to Plant Pathology where he hopes to learn the skills necessary to pursue a career as a college professor.

Plant Pathology Master's student **Blake Webster** originally was on a path to becoming a physical therapist, but during his senior year he got involved with a plant pathology research lab and never left.

Using Computers to Learn About Plant Disease



Graduate student **Matthew Haas** utilizes computer programming tools to make sense of large sets of genetic information

In order to learn more about how barley resists disease, graduate student **Matthew Haas** analyzes its genetic profile. Current technologies allow researchers like Haas to observe hereditary information that resides within a plant's DNA. A plant's DNA comprises billions of nucleotide building blocks, and Haas utilizes tools that allow him to efficiently and accurately provide biological meaning to this information by understanding which genes or genetic relationships allow a plant to recognize and resist pathogens. "Since the barley genome is almost twice the size of the human genome, methods of reducing data complexity are essential for being able to draw meaningful conclusions," says Haas.

During a recent internship at Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung (IPK) in Germany, Haas expanded his knowledge of the computer programming tools essential for making sense of large sets of genetic information. With the support of departmental funding Haas spent three weeks at IPK, a premier plant genetics research institute located in Gatersleben, to improve his computing abilities and advance his research on spot blotch (caused by *Cochliobolus sativus*) of barley.

Spot blotch is a historically important disease in the Midwest, causing significant yield losses in barley fields. Previous research revealed the genomic location of different barley genes that confer disease resistance, and Haas' research expands on what is known about these genes by investigating how they function at a molecular level. Working with IPK partners, Haas acquired new analytical computing skills to assist him with efficiently recognizing differences within barley plants' genetic code that cannot be read by humans. These minor differences have a major effect, and Haas' research will increase the understanding of what allows barley to resist spot blotch.

The skills Haas learned at IPK will continue to inform his research and allow him to independently and more efficiently analyze large data sets. "I was able to improve my own computing abilities so that I would not be dependent on others when conducting research, and learn new computing skills that allow me greater flexibility and control over my data analysis," says Haas. On the trip to IPK Haas also learned about other computational tools useful to his research, as well as genomics in other crops such as rye. "Overall, my research experience at the IPK was a positive and productive experience."

Plant Pathology Honors & Awards

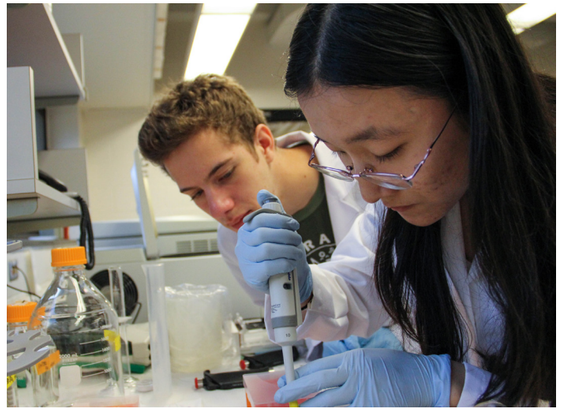
Carol Ishimaru honored with APS Fellow award

Department of Plant Pathology Professor **Carol Ishimaru** has been named a fellow of the American Phytopathological Society, an honor earned by only a few members of the society that recognizes distinguished contributions to plant pathology or to the society. Ishimaru is a former head of the Department and was president of the national society in 2012.

Dean Malvick Receives Distinguished Extension/Outreach Award

Dean Malvick, Professor in the Deparment of Plant Pathology and Extension Plant Pathologist, was awarded the Distinguished Extension/ Outreach Award. This award recognizes faculty and staff who have made significant contributions to extension/outreach education, and have made significant engagement efforts that link CFANS and the University of Minnesota to the citizens of the state.

Feng Li Receives MnDRIVE Global Food Ventures Graduate Fellowship



Plant Pathology graduate student **Feng Li** was awarded a MnDRIVE Global Food Ventures Graduate Fellowship. Recipients of this fellowship were selected based on academic record, research productivity, and alignment with the goals and objectives of this initiative.

Feng's research focuses on uncovering determinants of stem rust resistance in the model grass Brachypodium by following a reverse genetics approach to characterize the role of genes in Brachypodium that may mediate the defense responses against *Puccinia graminis* f.sp. *tritici*, the causal agent of stem rust. The aim of her project is to unravel molecular mechanisms that are pivotal for the plant to recognize the pathogen.

Stanwood Johnston Fellowship Awarded to Josh Kielsmeier-Cook

PhD graduate student, **Josh Kielsmeier-Cook** has been awarded the University of Minnesota's prestigious Stanwood Johnston Fellowship for the 2015-2016 academic year. The fellowship is awarded to one graduate student per year. It is awarded based on the student's prospect and promise in the fields of biochemistry, chemistry, geology, geophysics, microbiology, and physics.

Sara Bratsch Receives Doctoral Dissertation Fellowship Award

Graduate student **Sara Bratsch** was awarded the Doctoral Dissertation Fellowship Award. This fellowship is awarded to University of Minnesota Doctoral Dissertation Fellows who have been accepted to present their research at a national or international conference.

Her current thesis research involves characterizing a novel virus-like filamentous particle in the Asteraceae family, and also includes describing the distribution and diversity of orchid viruses in the U.S.

More Information About Plant Pathology Honors & Awards

The Department of Plant Pathology congratulates those who have won both external and departmental awards, and is thankful for the hard-work and support of those who continue to allow the Department to be successful and grow.

If you are interested in more information about the external and internal awards that our faculty, students, and staff earned this year, please visit our webpage: https://plpa.cfans.umn.edu/honors-awards

2015 Plant Pathology
Honors & Awards

Distinguished Alumnus Award
Kathy Kromroy

Friends of the Department
Don, Sandy, and Drew Henry

Norman E. Borlaug Fellowship in International Agriculture With Support From the Vaala-Henry Endowment
Feng Li

Fred I. Frosheiser Scholarship
Sara Bratsch

John Dueck Plant Pathology Fellowship
Josh Kielsmeier-Cook

M.F. Kernkamp Scholarship
Nick LeBlanc

Ward C. Steinstra & Richard A. Meronuck Graduate Student Travel Award
Josh Havill, Austin Case, Matthew Haas

Carl & Johanna Eide Endowment
Garrett Beier

Civil Service Award of Excellence
Todd Busker & Tamas Szinyei

Professional & Academic Award of Excellence
Lori Buboltz

Common Good Award
Bob Blanchette, Derek Camitsch, Rebecca Curland, Leon Van Eck, Amy Neeser, Kristen Optiz, Nevin Young, and Richard Zeyen

Celebrating the 2015 Recipient of the E.C. Stakman Award: Jeff Ellis

The E.C. Stakman Award is awarded each year in honor of Dr. Elvin Charles Stakman, a pioneer in wheat stem rust research. Stakman dedicated his career to find ways to incorporate rust resistance into wheat, and he developed tools that remain in use across the field of plant pathology today.

This year's award winner **Jeff Ellis**, Program Leader at Commonwealth Scientific and Industrial Research Organisation (CSIRO) Plant Industry in Australia, shares Stakman's vision of protecting crops from disease, and through his work Ellis has extended Stakman's legacy by identifying many of the underlying genes that control rust resistance. Ellis was presented this year's award on Oct. 22 where he also gave a research seminar highlighting rust resistance research.

Ellis was one of the first scientists to apply molecular genetic techniques to studying disease resistance. One of these techniques involved continued research on the gene-for-gene concept, a widespread and very important aspect of plant disease resistance originally discovered by Dr. Harold Flor (PhD 1929). Having knowledge of these gene-for-gene relationships has proved to be an essential tool for controlling plant disease. Working in the same flax rust disease system as Flor, Ellis identified the components controlling the genetic interaction between flax and rust. His findings on this topic have shaped the way scientists understand pathogen interactions in plant systems. Ellis was also recognized as a worldwide leader in the field of molecular plant-microbe interactions since he conducted some of the earliest investigations on the identification of components of the plant immune recognition system.

Not only has Ellis excelled in his research endeavors, but has been dedicated to educating the next generation of plant health leaders.

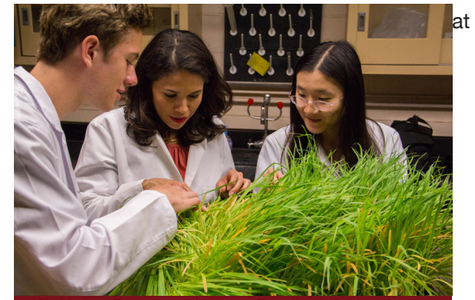
"Jeff was an excellent mentor, and I have always been impressed by the scientific rigor that he brings to his work. One of the great things I learned from Jeff is the importance of melding excellent basic science with practical applications in the field," says Peter Dodds Science Leader at CSIRO and a former postdoctoral student of Ellis.

Ellis' commitment to education and scientific achievements have inspired the world's plant pathologists, and through his publications, presentations, and mentorship he will continue to do so in the future.

Faculty News & Activities

Melania Figueroa

What a fantastic year we've had! My research program continues to grow, and we are diving in new projects and directions. There is no doubt we are a very active group and we stay busy! This time the coordination and vision of the Stakman-Borlaug Center to create opportunities to tackle plant health problems have taken us to exciting adventures. Oat crown rust is a disease of great importance at a national and international level, and given the industry's current needs in this area my lab is investing a lot of energy to control this pathogen. In collaboration with **Dr. Shahryar Kianian** at the USDA-ARS Cereal Disease Laboratory, **Drs. Gabe Gusmini** and **Haiyan Jia** from PepsiCo/Quaker, Dr. Robert Park at the University of Sydney and support from the University of Minnesota Small Grains Initiative, we are working toward building tools to identify sources of disease resistance against oat crown rust. At the same time, we are also building genomic resources that can help design more efficient ways to deploy oat varieties with genetic resistance against oat crown rust. Another exciting project is our collaboration with **Dr. Ruth Dill-Macky.** We are investigating oat genetic resistance against loose smut, a new pathogen for me. These new projects brought three additional staff into my laboratory: **Susan Rottschaefer** (technician), **Laura Souther**, (undergraduate research assistant) and **Dr. Vahid Omidvar** (postdoc who will join us in December). Our project in non-host resistance against rust fungi continues to move forward. My graduate student **Feng Li** is doing a marvelous job handling all rust that comes her way. I truly enjoy watching her grow as a scientist. Our stem rust-related work has also expanded. In collaboration with **Dr. Brian Steffenson** and colleagues at CSIRO, Australia, we are taking new angles to define virulence factors in this pathogen. This September we also welcomed a new graduate student, **Katarina Sweeney**, who is part of the brown rot team, and is making headway with her courses and navigating her research interests. It is with a little bit of sadness that we say a "temporary good-bye" to our undergraduate student **Leif van Lierop**. Lief will be studying abroad for a semester, followed by an internship in the fall. We will be awaiting for his return the following year; in the meantime, we are excited about all the new stories he will share with us.


Dr. Melania Figueroa and students Feng Li and Lief van Lierop examine rust

Attending conferences is always a highlight. This year, I was honored to speak at the Plant and Animal Genome Conference, where I ran into many of my friends and colleagues. I also attended the Borlaug Global Rust Initiative Workshop in Sydney, Australia, where again I reunited with my colleagues from the UK, Australia, Brazil, Chile, Uruguay and even the US. It is always fun to spend time together. I am still learning the ropes as assistant professor, and juggling so many multiple roles can be tricky at times. However, I am very lucky to be surrounded by a wonderful lab, department, coworkers and friends, who make it all worthwhile. To all of you, thanks!

Jennifer Juzwik

Research efforts in the Juzwik lab during 2015 focused on the etiology of Thousand Cankers Disease (TCD) and molecular methods for detection of the oak wilt fungus in sapwood of diseased oaks. Documentation of the ambrosia and bark beetles and bark weevils colonizing TCD-symptomatic black walnut in Butler County, OH, that was initiated last year was repeated in 2015. Two ambrosia beetle species and a weevil species commonly emerged from stem samples of felled trees were found to be contaminated with viable propagules of the TCD fungus. The roles of these species in the epidemiology of TCD and the development of tree dieback are of much interest to our lab and to our entomology cooperators (Dr. Matt Ginzel and graduate students) at Purdue University. We also documented putative pathogenic fungi isolated from various stains, cankers and insect damage found on the branches and the main stems of the same trees. We found the extensive use of drawknives for carefully debarking our trees is great exercise for the upper body! Our research also reached new heights as we inoculated branches of up to 90 foot tall black walnut trees in plantations and park settings in Indiana and Ohio using aerial lifts and ladders. Our goal is to compare the ability of the TCD fungus to that of the other putative pathogens isolated to cause cankers that may potentially coalesce and lead to branch dieback following multiple inoculations of each branch (see photo next page).

In late June, **Anna Yang** successfully defended her M.S. thesis research on evaluation of nested PCR and real time PCR for detection of the oak wilt fungus in the sapwood of diseased red, bur and white oaks. The detection rates were compared to those achieved using a standard culture technique. Anna's love for diagnostic work developed from

working in the department's Plant Disease Clinic as an undergraduate student.

Besides spending over 8 weeks in Ohio and Indiana over the field season, **Jenny Juzwik** traveled during the winter and spring months to give presentations at various meetings in Illinois, Maryland, Michigan, Nebraska, Ohio, and Wisconsin. She also served on the advisory committee and science subcommittee reviewing oak harvesting guidelines for the Wisconsin Department of Natural Resources with multiple meetings held between November 2014 and August of this year. Currently, Jenny serves on the U.S. Forest Service Research and Development organizing committee for the National Stakeholder Workshop on the State of the Science for Non-native Invasive Species and the writing team responsible for the written assessment that will follow the December meeting. It has been a busy year, even if work travel did not take her out of the country.

The time spent on grant writing efforts paid off with funding being awarded from USDA APHIS and NIFA for evaluation of phytosanitary treatments of oak and walnut logs for export purposes. Funding for the etiology of TCD research being conducted with Purdue University colleagues was obtained from the Forest Health Evaluation Monitoring Program. Lastly, **Brett Arenz** and Jenny were invited by **Dr. Abdennour Abbas**, Department of Bioproducts and Biosystems Engineering to submit a proposal with him to continue work on rapid techniques for detection of the oak wilt fungus in diseased trees. The successful proposal was one of the first awarded from the new Minnesota Invasive Terrestrial Plants and Pests Center at the University of Minnesota. With all these new projects, the next three years will be anything but dull!

Ashok Chanda

2014-2015 marked my first and a very productive year as a faculty member in the Department of Plant Pathology at the University of Minnesota. The mild winter of 2014 greatly helped my transition from hot Louisiana to cold Minnesota. My research group now has **Jason Brantner**, Senior Research Fellow, and **Jeff Nielsen**, Assistant Scientist. Jason and Jeff brought me up to speed with sugarbeet production practices, and I truly appreciate that. The sugarbeet pathology project received a brand new John Deere tractor with a cab so now Jeff can enjoy air conditioning in July while working the plots and run the fancy GPS while planting and harvesting. The personnel at the Northwest Research and Outreach Center (NWROC) were very kind and welcomed my family and me with open arms. They were also so helpful when we had questions.

We had a very productive field season with several projects aimed at developing disease management strategies for Rhizoctonia and *Aphanomyces* diseases of sugarbeet. The sugarbeet growing season started in mid-April with timely planting and our crew had fun spreading *Rhizoctonia*-infested barley inoculum in the test plots. The waste lime from the sugarbeet factory still proved effective against Aphanomyces root rot, even 11 years (initiated by **Carol Windels** in 2004) after the original application. Our lab received about 110 sugarbeet samples (mostly rotten) sent by growers from the Red River Valley and southern Minnesota and again *Rhizoctonia* was a clear winner with highest number of samples followed by *Aphanomyces*. The lab entered the molecular world by beginning to quantify *Rhizoctonia* DNA levels in soil. The five winter grower talks I gave this year were very productive in terms of meeting with the sugarbeet growers and conveying research-based disease management tactics to them. Our lab is collaborating with Dr. Mohamed Khan at North Dakota State University to address disease and agronomic issues common in North Dakota and Minnesota. I thoroughly enjoyed the weekly extension "Crop Calls" on Monday mornings to get an update on what's happening all around the state with the help of state specialists, as well as regional and local extension educators (thanks to **Madeleine Smith**). The growing season ended with the rating of diseased roots and throwing tare samples into Jeff's truck to be sent to the quality lab.

Sugarbeet Pathology Team during the 2105 Annual Crops & Soils Day at NWROC, Crookston. From left to right: Jason Brantner (Senior Research Fellow), Irwin Sylvah (Undergraduate Researcher), Ashok Chanda (Principal Investigator), Katie Sheetz (Undergraduate Researcher), and Brandon Kasprick (High School Researcher).

We had two high school students (**Tim Cymbaluk** and **Brandon Kasprick**) and three undergraduate students (**Katie Sheetz**, **Austin Lien** and **Irwin Sylvah**) working diligently during summer counting stands, setting irrigation tapes, washing and plating diseased sugarbeet samples, running growth chamber trials and performing soil DNA extractions. Our annual NWROC sugarbeet field day drew more than 125 growers and industry personnel to view the research plots and learn about the latest developments in the world of sugarbeet disease and weed management.

I presented my research at the 38th Biennial meeting of the American Society of Sugar Beet Technologists meeting in Florida from February 23-27. It was a good getaway since that was the coldest week of the 2015 winter in Crookston. I attended my first North Central APS division meeting in Michigan and was busy networking with several researchers. My visit to the Kellogg Biological Station (KBS) in Michigan was memorable. This year's annual sugarbeet researcher's tour was very well organized by Amalgamated Sugar Company in Boise, Idaho, and I was truly amazed by the 100% irrigated agriculture in Idaho and viewed some new production crops such as onions and stevia. The meeting ended with wine tasting at the Snake River Winery. The annual APS meeting in California was very productive with two poster presentations submitted by my lab. I also established new collaborators for research and connected with old friends. Our family vacation in the Black Hills of South Dakota was very relaxing and now my 4-year-old daughter knows what she calls a "Faces Mountain". I would like to acknowledge the funding support from the Sugarbeet Research & Education Board of Minnesota and North Dakota for our research projects. This year also marks as one of the best years for sugarbeet growers with some record high yields.

Nevin Young

Another year of travel and transitions for the Young Lab in 2015. In June, graduate student **Peng Zhou** defended his Ph.D. thesis, "Defense-related gene families in the model legume, *Medicago truncatula*: Computational analysis, pan-genome characterization and structural variation." Peng has now taken a position at the Minnesota Supercomputer Institute developing a big-data mining project for soybean and a resistance gene database for Rosaceae and Solanaceae. Research associate **Shaun Curtin** traveled to Ixtapa, Mexico to give a talk at the North American Nitrogen Fixation Conference, post-doc **Liana Nice** presented a poster at the Crop Science Society Meetings in Minneapolis, and graduate student, **Diana Trujillo**, presented a poster at Plant and Animal Genome XXIII in San Diego. In September, **Nevin Young** traveled to Amsterdam, Netherlands to give a keynote presentation at the Plant Genome Evolution 2015 conference. While there, he visited the famous De Hortus Botanicus gardens, which were originally established in 1638. There, he encountered a surprising (and quite massive) specimen of the legume genus, *Ononis*, plants that would be excellent sources of nodule specific cysteine-rich peptides, proteins of great interest in the field of symbiosis research. Then in October, Nevin visited Champaign-Urbana to give the Plant Sciences weekly seminar, including meetings with Minnesota alumni Katie Heath and Brian Diers. The lab hosted the annual NSF Medicago Hapmap meeting, this year at the Campus Club in Minneapolis, with participants from J. Craig Venter Institute (JCVI), Boyce Thompson Institute, Cornell, Noble Foundation, National Center for Genome Research, UCLA, Michigan State, Hamline, and Cold Spring Harbor Institute. Nevin also found time to go out to dinner with former department head **Phil Larsen** and his spouse, Sandy — as well as a reception with **Debby Drange** and **Connie Post** and a lunch with **Jim Kurle**, **Dean Malvick**, and retired Plant Pathology professor, **Jim Percich**.

Angela Orshinsky

This year was very exciting and very busy in the Orshinsky lab. This year, my lab traveled over 12,500 miles just in Minnesota to identify plant diseases and conduct research trials. That is the equivalent of travelling halfway around the world! So what did we spend our time doing this year?

In our pursuit of characterizing snow mold populations within Minnesota, we started the year at snow melt traveling to golf courses across the state to collect snow mold samples. Although there was much less snow cover than the previous year, we found several types of snow mold fungi affecting golf course turf including pink snow mold, gray snow mold, speckled snow mold, and snow scald. This is the second year with multiple snow scald reports on golf courses, and we do not currently know what chemicals work for this disease. Therefore, we conducted fungicide sensitivity assays in the lab to determine the relative sensitivity of the snow scald pathogen to over 15 fungicides. We used this information to design an inoculated field trial of these fungicides that will be conducted this winter. In addition to snow mold research, we spent much time studying methods for reducing the environmental impact of fungicide use on golf course greens, the efficacy of plant defense activators on golf course green disease management, and diagnosing plant diseases for home lawns, sports turf and golf courses throughout the state.

Application of fungicides for this winter happened in early November

Our hop disease survey was in its first field season this year, and we found downy mildew throughout the state. Downy mildew is the most important disease of hops worldwide and can cause devastating losses to hop production in areas such as the Midwest where the cool, humid conditions are extremely conducive to downy mildew development. In addition to downy mildew, we found powdery mildew, *Fusarium* bine wilt, Apple mosaic virus, Hop latent viroid, Hop stunt viroid, Hop mosaic virus, Hop latent virus, American hop latent virus, and *Alternaria* cone disorder. Our current lab research is working to screen cultivars, wild hops, and fungicides for use against downy mildew and powdery mildew. We're also working on methods for high-throughput diagnoses of hop viruses and viroids to assist in testing propagative material. This past summer, we also conducted a limited project on the effects of nitrogen fertilization amendments and

timing on the growth, yield, and alpha acid content of hops.

The high tunnel network survey, initiated in 2013, finished this season. This project involved travelling to high tunnels throughout Minnesota three times during the growing season to assess diseases on solanaceous crops. In 2014 and 2015, we diagnosed over 200 samples each year. We found an array of diseases, the most important being *Botrytis* gray mold, leaf mold, early blight, and *Fusarium* crown and root rot. Primary viruses of importance were Tomato spotted wilt virus and Tobacco/Tomato mosaic virus. A follow up study on leaf mold epidemiology and biology is currently underway by new lab members, **Lillian Garber** (MS student) and **Dr. Nick LeBlanc** (postdoctoral researcher).


Severe defoliation of bottom leaves of high tunnel tomatoes due to leaf mold.

In addition to these projects, plans for next year include beginning to trial conventional and organic pesticides for leaf mold and *Botrytis* gray mold management on tomato in high tunnels. For more updates on my research and Extension program, visit: http://hortpathology.cfans.umn.edu/.

Deborah Samac

The Samac lab continues to grow and evolve. This year we welcomed **Dr. Sarah Castle**, a postdoctoral scientist working with us and the Kinkel lab to characterize the soil microbial communities in the UMN Long Term Agricultural Research sites and Chinese visiting scientist **Dr. Yuanyuan Cao**, from Anhui Agricultural University. Dr. Cao is working with Dr. Bruna Bucciarelli to help us develop digital phenotyping methods of alfalfa root systems and investigate alterations in root architecture from microbial associations. This work is funded by a grant from the NIFA-Alfalfa and Forage Research Program. Graduate student **Laurine Berg** completed her M.S. thesis identifying *Pythium* species causing damping off and seed rot of alfalfa. She found a surprising amount of fungicide resistance, which may partially explain the increasing problem of damping off in alfalfa. Graduate student **Andrew Sathoff** has done excellent work to evaluate antimicrobial peptides for the activity against alfalfa pathogens with the goal of developing alfalfa plants with greater resistance to crown rot organisms. We are continuing research to identify DNA markers associated with resistance to *Aphanomyces* root rot and to characterize new strains of this important pathogen. ARS Research Associate **Dr. Chris Klatt** continues research to characterize the microbial populations associated with alfalfa roots. **Dr. Claudia Castell-Miller** has recently re-joined the lab to continue research on wild rice pathogens, from funding provided by the Minnesota Wild Rice Council. Due to ARS retirements, the lab has grown to include ARS technicians **Keith Henjum**, **Ted Jeo**, **Sue Miller**, and **Peter Lenz**. **Mindy Dornbusch** continues to keep us all in line and keep research proceeding on a multitude of projects. Her expertise and skills were recognized this year when she received the Civil Servant of the Year Award from the Federal Executive Board of Minnesota. We hope to be able to start hiring new research scientists in the next year to replace the four retired scientists in the Plant Science Research Unit. The next year promises to be exciting and productive!

Dean Malvick

My research/extension group and collaborators have continued our multipronged research and extension teaching efforts to understand and reduce the damaging effects of key diseases on soybean and corn crops. These two crops were produced on nearly 16 million acres in Minnesota from the Iowa to Canadian border in 2015. Diseases that significantly reduce yields never fail to appear across this large area every year. It was a productive and interesting year.

Our research efforts on soybean have focused on the diseases brown stem rot, sudden death syndrome, Rhizoctonia root and stem rot, white mold, and Pythium seed and seedling blight over the past year, along with lesser efforts on other diseases. **Crystal Floyd** (Research Fellow) has continued her excellent and critical work on many projects and keeping the lab, greenhouse, and field work running as smoothly as possible under frequent challenges of many different types. She has been assisted by a rotating group of undergraduate student assistants who contribute their many skills while they learn about plant pathology. Several projects are nearing completion, and several other projects were initiated this year. Results from some of our work were presented at the North Central APS meeting in Lansing, MI in June and at the National APS meeting in Pasadena, CA in August.


Goss's wilt research site in Rosemount, MN

Our efforts on corn diseases have continued to focus on Goss's wilt of corn, with smaller projects on northern corn leaf blight, *Rhizoctonia* root rot, and a few others that intrigue us. Goss's wilt continues to be a widespread problem in Minnesota, albeit not as severe in 2015 as it was a few years ago. **Carol Ishimaru** and I collaborate on this disease, and our research continues to be fascinating and productive. **Ryan McNally** (Postdoctoral Associate), **Blake Webster** (M.S. student), and **Rebecca Curland** (Research Fellow) along with enthusiastic undergraduate assistants make a great team that is pushing the frontiers of Goss's wilt work forward. There is so much to learn about Goss's wilt, and fortunately the disease usually develops in our studies as planned now that we have our methods closer to perfection. Consistently obtaining strong symptoms within a week or two of inoculation is a joy in contrast to the six to seven weeks that are often needed for development of brown stem rot symptoms in soybean. Results from some of our work on Goss's wilt were presented at the APS meetings in Michigan and California.

My research program continues to inform and be informed by my extension education program. My presentations at local and regional conferences, meetings, workshops and field days in Minnesota, as well as presentations in other states including Illinois and North Dakota in the past year have allowed me to spread key messages on the biology and management of important diseases in the region. Many of the folks that I speak to and interact with at these events and via phone and email correspondence are keen observers and critical thinkers about crop production challenges, and they rarely fail to provide useful ideas and insights that feed back into my research and extension programs. Now as I look forward to next year, I see more interesting projects, several coming to a conclusion, and, as always, more new issues and challenges than I can anticipate.

Jim Kurle

This past year has been a productive one for my research group and me. In spring semester, I used the time provided by a leave of absence to complete data analysis and summarize the results of an eleven state survey of *Phytophthora sojae* pathotypes found in the North Central States. In my absence lead scientist, **Grace Anderson**, guided an energetic group of undergraduate assistants and researchers in continuing research in my laboratory. **Dante Leyva-Leven** and **Marissa Scherven** are dedicated undergraduates whose enthusiasm and effort have contributed substantially to productivity in the lab. Marissa finished her undergraduate degree program Fall Semester and is planning on graduate study in Plant Pathology. Marissa's experience is typical of students who find their way into Plant Pathology as student employees knowing little about the discipline but with enthusiasm for and an interest in plants and plant science. Her story is presented at: https://www.youtube.com/watch?v=JJMNw8abW10.


Undergraduate research techs Skyler Werner, Daniel Monnens, and Victor Brenk in SDS plots.

We also have several new undergraduate laboratory staff including **Victor Brenk**, **Daniel Monnens**, and **Skyler Werner.** This group makes possible the large-scale resistance phenotyping effort that is currently the focus of my research program. This effort is directed at evaluating several hundred early maturity group soybean lines for resistance or tolerance to *Phytophthora sojae, Fusarium graminearum, Pythium irregulare* and *Pythium ultimum*. The phenotype results support research utilizing molecular techniques to identify molecular markers for resistance in soybean lines adapted in Minnesota. Our research is generously supported by the Minnesota Soybean Growers and the United Soybean Board.

Graduate and undergraduate education is an essential component of my program. In that role, I co-advise several graduate students including **Jordan Briggs** with **Matt Rouse** of the Cereal Disease Lab, and **Juan Mayta** with **Jim Orf**. My undergraduate class ("Plants Get Sick Too") attracted 38 students in Fall Semester. A field tour of plant disease examples utilizing "augmented reality" accessed through an iPhone"app" was developed in collaboration with Dr. **Brad Hokansen** of the Design Department and his Research Assistant, **Jennifer Hoeke**.

Lorien Radmer completed her research into the *Pythium* species infesting soybean in Minnesota. Her efforts expanded our understanding of soybean seedling and root diseases prevalent in the state. She identified more than thirty *Pythium* species, many of them pathogenic on both corn and soybeans. Several had not been reported previously in Minnesota. She also investigated the efficacy of five fungicides applied as seed treatments. Her results were presented as a poster at the APS national meeting in Pasadena and are the basis for a paper to be submitted for review to *Plant Disease*.

Jim Bradeen

We have had a very productive year in 2015. Our research program continues to develop new knowledge and research approaches to improve plant disease resistance. We are especially interested in using genomics to mine genebank collections for disease resistance genes for crop improvement. With our collaborators at the University of Naples, we published the first genome sequence of a wild potato species. (We even made the cover of *Plant Cell*!) *Solanum commersonii* is a wild potato with resistance to both diseases and environmental stresses (especially cold). The availability of this sequence will greatly improve our ability to transfer resistance genes from wild potato to the cultivated types. Also in 2015, postdoc **Leon Van Eck** continued to lead a project funded by the State of Minnesota through the MnDRIVE initiative to develop informatics methods for visualizing evolutionary patterns of disease resistance genes across the Rosaceae family. The Rosaceae includes apple, peach, and strawberry. Leon's work will help pathologists and geneticists make better use of genebank collections for developing crops with improved disease resistance. His informatics pipeline led to interesting hypotheses about the impacts of crop domestication on the evolution of disease resistance. We will be testing these hypotheses in future research. Leon presented his research at the Plant & Animal

Genomics Conference in January and the American Phytopathological Society Annual Meeting in August. I also presented Leon's research as part of a keynote address at the European Association for Potato Research meeting in Naples, Italy in November. Looking forward, we will semi-automate our informatics pipeline and use it to create improved disease resistance gene datasets for the Rosaceae and Solanaceae (potato, tomato, eggplant). We are especially interested in evolution of late blight resistance genes in the Solanaceae. We will also optimize research approaches to generate disease resistance gene DNA sequence information from genebank collections in both plant families. The long-term impact of this research will be improved crop adaptation to a changing climate, reduced fungicide usage for plant disease management, and more robust understanding of the factors driving plant pathogen evolution. Finally, along with Stakman-Borlaug Center Managing Director **Karen Hokanson**, we were funded this autumn by USAID as part of a five year project led by Michigan State University to develop late blight resistant potato varieties for Indonesia and Bangladesh. This project will make use of late blight resistance genes from wild potato species to reduce fungicide usage and improve food security.

Postdoc Leon Van Eck

Loretta Ortiz-Ribbing

One of the highlights for my project this year was the publication of an article (in Natural Sciences Education 44:112-121) on how undergraduates perceive peer review. Having strong written and oral communication skills are powerful workplace and graduate school tools. Using peer review is one documented method in undergraduate curriculum to improve student writing. However, few studies have been advanced to evaluate the perceived types and degree of benefit students place on using the peer review process. In this paper with co-author **David Zlesak** (faculty at the University of Wisconsin-River Falls), we report on a multi-semester study evaluating student perceived benefits of different peer review models for written and oral assignments in three different plant science courses. We found that students benefited by increased understanding of assignment guidelines, gaining ideas from their peers, and from acting as reviewers--all of which helped students improve their assignments. These results will hopefully inspire other plant science faculty to use peer review in their courses. We suggest strategically integrating peer review into courses and identifying strategies for when to best use different peer review models.

Ruth Dill-Macky

Although *Fusarium* head blight (FHB or scab) of wheat and barley remains the most important disease impacting small grains in Minnesota, members of my small grains pathology lab are also working on a number of other diseases of small grains. **Justin Stanton**, an M.S. student co-advised with **Madeleine Smith**, has been developing and refining methods to inoculate field nurseries for the identification of host resistance to bacterial leaf streak of wheat and barley. **Anil Adhikari**, also co-advised by Madeleine Smith, is completing his M.S. research identifying resistance to net blotch of barley, and he is examining the populations of viruses associated with cereals in Minnesota. Their work on root diseases has also expanded in recent years with the recognition that *Fusarium* species have become the most prevalent root pathogens of wheat in Minnesota. This fall, **Dr. Mark Winter,** from Georg-August-University Goettingen in Germany, joined the lab as a visiting scientist. Mark will be visiting for a year, working largely on *Fusarium culmorum* in association with wheat roots. His research will have synergy with the expanding effort on *Fusarium* crown rot of wheat in the small grains pathology lab and with **Linda Kinkel**'s program as Mark will also be looking at the interaction of Fusarium and soil microbes including *Streptomycetes*.

Ruth Dill-Macky with trainees in the field. Learning to score leaf diseases (rusts and *Septoria)* and *Fusarium* head blight were among the hand-on activities trainees participated in during the workshop.

Brian Steffenson

From February to May of 2015, I took a semester leave at the Institute for Cereal Crops Research (ICCI) at Tel Aviv University. The ICCI and the Department have had formal research linkages since the 1950s when **Professor Isaac Wahl** first visited E. C. Stakman in St. Paul. While in Israel, I had a chance to survey the country for wild cereal relatives and their pathogens, learn the techniques for introgressing genes from *Aegilops* species into wheat, and have many great discussions about research and other current topics with **Yehoshua Anikster, Eitan Millet, Hanan Sela, Assaf Distelfeld, Jacob Manisterski, Pnina Ben-Yehuda** and **Amir Sharon**. It was an amazing experience for me to be able to collect wild germplasm next to many famous historical sites such as the Old City of Jerusalem, Sea of Galilee, and ancient seaport of Jaffa. I also had time to visit colleagues at the University of Haifa (**Tzion Fahima** and **Abraham Korol**) and the Volcani Institute (Roi Ben-David). During the year, we continued our full schedule of disease phenotyping experiments with *Fusarium* head blight, stem rust, leaf rust, stripe rust, net blotch, spot blotch, and bacterial leaf streak. A new initiative on the project is developing hardy malting barley cultivars that can be sown in the fall and survive the harsh Minnesota winters.

Brian Steffenson emasculating florets of *Aegilops* for crossing experiments.

During my absence in Israel, the project ran smoothly with my able Junior Scientists of **Tamas Szinyei**, **Matthew Martin**, and **Cole Williams**. Cole left the project in the spring to become a full time mother, and **Ryan Johnson** replaced her. My current graduate students of **Matthew Haas** (Mapping of *Fusarium* head blight resistance and RNAseq analysis of a spot blotch susceptibility mutant in barley), **Austin Case** (Genetics and mapping of stem rust resistance in barley), **Matthew Martin** (Leaf rust of barley and characterization of induced mutants in the stem rust fungus), and **Shuyi Huang** (Characterization of phenotypic diversity in *Aegilops longissima*) are making good progress toward their respective M.S. and Ph.D. degrees. I also welcomed a new M.S. student (**Fazal Manan**) from Pakistan who will work on multiple disease resistance and milling quality in a nested association mapping population of wheat. We also had **Dr. Ahmad Sallam** join our project as a Postdoctoral Resarch Associate. Ahmad will work on the genetics of stem rust resistance and low temperature tolerance in barley. Several of my project members attended conferences and workshops: Tamas Szinyei attended the Field-based High Throughput Phenotyping Workshop from March 16-19 in Maricopa, AZ; Matthew Haas did a three-week internship from March 9-28 at the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) in Gatersleben Germany; and Austin Case attended the 2015 Borlaug Global Rust Initiative Workshop from September 17-20 in Sydney, Australia.

I was fortunate to have on my project an excellent new cadre of undergraduates to help in various aspects of our research. They include Ryan Johnson, **Hannah Kempher**, **Alison Knoble**, **Angela Tomlinson**, **Sarah Speier**, and **Wen Jing**. We also had two excellent MAST students from the country of Georgia work for us as well: **George Saparashvili** and **Giorgi Beruashvili**. During the summer, we hosted **Alexander Hulse**, a Borlaug Youth Institute Scholar. Alex is a student from Whitman College in Washington and conducted research relating to the evolution of the stem rust resistance in wild barley. Congratulations to Matthew Haas who received a Minnesota Discovery, Research, and Innovation (MnDRIVE) fellowship and to Tamas Szinyei who received the Department's Civil Service award in 2015.

We had to say farewell to a number of outstanding lab personnel during the past 12 months: **Courtney Pratt, Katie Ring, Blake Nelson, Cole Williams, Evandro Henrique, Figueiredo Moura da Silva, Nathalia Salgado** and four-year veteran **Ryan Gavin**. We look forward to an exciting and productive year in 2016!

Jonathan Schilling

The past year has been busy in **Jonathan Schilling**'s lab, where the focus is on fungal mechanisms for degrading plant tissues. Most of the funded work remains biological, but there is a distinct bubbling of ecologically-oriented projects in the lab, spurred by a sabbatical in 2013-14 and the collaborations that it has fostered.

On the biology side, a new Department of Energy grant has facilitated more visits to Borlaug Hall. That project collaboration includes **Melania Figueroa** and **Jim Bradeen**, along with a new Plant Pathology graduate student, **Kat Sweeney**. Welcome Kat! The work is focused on fungal mechanisms of wood degradation, specifically those of brown rot fungi, and it is in collaboration with several Federal labs. Kat is doing some work at the Pacific Northwest National Laboratory's Environmental Molecular Sciences Laboratory (EMSL) with fluorescence in situ hybridization (FISH) and immunolocalization of cellulases in wood cells. She is also working collaboratively in an effort to use transcriptomics to better understand which genes make these fungi so efficient in rotting wood. Two postdocs, **Jiwei Zhang** and **Hideki Suzuki**, are involved with this effort, as well as the Federal research teams. This is a fun project, it is basic science, and it is already giving us some insights into a group of organisms important in industry, as tree pests, and as key players in the global carbon cycle.

A student **Gerry Presley**, funded by an NSF Graduate Research Fellowship, is now in South Africa for 9 months, thanks to the USAID GROW program. This is turning out to be an adventure, given student uprisings, campus closings, and a lot of time working out of the local café on manuscripts rather than proteomics at the bench. Another of Jonathan's former Ph.D. students **Zewei Song** has also joined the Plant Pathology department as a postdoc with **Linda Kinkel** and continues to crank full steam ahead, with two adorable children and a wife Ming who is now full-time in the Reich lab in Forest Resources. Two Ph.D. students graduated (**Justin Kaffenberger** and **Jason Oliver**), and one graduate student has returned from Kaula Lampur (Feng Jin Liew) as an M.S. student, so there has been turnover, but also a sense of accomplishment heading into a new year.

A Graduate Student's Year in Review

By: Austin Case

First I would like to start off as usual by relaying the outcome of the Stakman Softball Game. The students once again were victorious over the faculty! However, this time it took a come from behind last inning rally. With this win, the students evened the series during my tenure to two and two, with a rubber game set for next season in 2016. Way to go team! Keep it up!

This year we welcomed seven new graduate students to our ranks. I extend a very warm welcome to our new graduate students and wish them the best of luck in their studies. With such a large group of new students, I am sure we will have a fun time getting to know each other. This past year has been productive for the graduate students with five alumni finishing their degrees and departing for bigger and brighter things. Congratulations to our departing colleagues and please stay in touch.

It has also been a prolific year for professional development among the graduate student body with many of us attending regional and national meetings such as the APS North Central Division meeting in East Lansing, Michigan and the national APS meeting in Pasadena, California. Not only have we been active nationally, many of us have also traveled internationally. At the most recent Borlaug Global Rust Initiative meeting in Sydney, Australia there was a large cohort from Minnesota, where **Melissa Lim** won best graduate student poster. Congratulations Melissa! Some students have traveled to far flung places for research. This past year, our graduate cohort made our presence felt on at least five continents: from **Jordan Briggs** and myself traveling to Kenya for stem rust research to **Josh Kielsmeier-Cook** traveling to Ecuadorian rain forests in search of diverse Xylariaceous fungi, We have also taken advantage of departmental supported internship opportunities. This past year, **Matthew Haas** traveled to Gatersleben, Germany for an internship at the Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung (IPK) with Martin Mascher, where he worked on a bioinformatics-focused internship analyzing data from an RNA-seq experiment of a spot blotch susceptible mutant, performing sequence alignment and expression analysis. Jordan Briggs traveled to Canberra, Australia for an internship at Commonwealth Scientific and Industrial Research Organization (CSIRO) with Wolfgang Spielmeyer, where he worked on understanding the genetics of resistance to stripe rust and stem rust in a variety of host cultivars and near-non-host species, using mutagenesis to knockout the genes thought to be important in the resistance reaction and timing of expression. This is but a small sample of the diverse activities that the graduate students have been engaged in this past year.

We have, however, also maintained our focus on things other than academia. The Plant Pathology Student Organization remains committed to outreach activities in schools and the community at large. We have also made time for social activities, attending Gophers athletics events and happy hours at local craft breweries such as Surly and Dangerous Man.

As you can see from this summary, the graduate students are taking full advantage of the academic and social opportunities in the department and are looking forward to what the next year will bring.

Welcome To Our New Graduate Students

Zennah Kosgey

Zennah is pursuing a Ph.D. advised by **Dr. Matthew Rouse**. Her research focuses on developing durable resistance to stem rust (***Puccinia graminis*** f. sp. ***tritici***) in wheat. She is a native of Eldoret, Kenya where she received a B.S. in Botany from Moi University and a M.S. degree in Plant Breeding from Egerton University. She comes to the Department directly from the front lines in the battle with Ug99 stem rust, having focused on it during her master's research. Zennah's hope in attaining her doctorate is to contribute to food security by developing disease resistant wheats that will withstand attack from virulent and ever-evolving pathogens. When not working with stem rust, Zennah enjoys hiking and playing soccer.

Lillian Garber

Lillian Garber is pursuing a M.S. degree advised by **Dr. Angela Orshinsky**. Her research is focused on tomato leaf mold (***Passalora fulva***) in high tunnels in Minnesota. She will be characterizing the prevalence of different ***P. fulva*** races in Minnesota, the frequency of avirulence gene mutations and distribution of mating types. Lillian is a native of Plymouth, Minnesota, and prior to joining the Department received a B.S. degree in Environmental Sciences, Policy Management from the University of Minnesota. She enjoys camping, reading, watching movies and doing puzzles. She was drawn to the Department after working in plant genetics at the USDA-ARS and later working for Dr. Carol Ishimaru. She hopes to someday work with horticultural crops in either industry or academia.

Lauren Jackson

Lauren is pursuing a Ph.D. advised by **Dr. Robert Blanchette**. His research focuses on identifying and characterizing mechanisms of wood decay fungi in the sub-phylum Agaricomycotina. Specifically, he is interested in the strategies employed by fungi to colonize different substrates and what factors control their respective generalist or host-specific lifestyles. Lauren holds a B.S. degree in Plant Science and a M.S. degree in Plant Pathology from the University of Arizona. He is a native of Portland, Oregon and enjoys playing games, hiking with his family and sampling craft beers. His favorite fungus is ***Pleurotus ostreatus*** (oyster mushroom). Lauren was drawn to Plant Pathology because he is committed to making a difference by improving agricultural productivity and biotechnological processes to address food security and climate change.

Deepak Rajendran

Deepak is pursuing a Ph.D. degree advised by **Dr. Senyu Chen** in Plant Pathology and **Dr. Kathryn Bushley** in Plant Biology. His research will focus on identification of biocontrol agents of the soybean cyst nematode (***Heterodera glycines***) and their molecular mechanisms. Deepak is a native of Chennai, Tamilnadu, India and holds a Bachelors and Master of Technology in Industrial Biotechnology from SASTRA University, Thanjavur, Tamilnadu, India. He was drawn to Plant Pathology because it gave him the opportunity to study plants, microbes and nematodes. Deepak's career goal is to improve the quality of lives of people in predominantly agrarian economies and wants to someday be involved in policy making. He enjoys singing, driving, cooking, reading fiction and biographies. His favorite fungi are those in the genus ***Fusarium*** because of their wide host range.

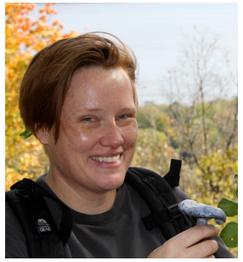
Eric Otto

Eric Otto is pursuing a M.S. degree advised by **Dr. Robert Blanchette**. His research is focused on ***Heterobasidion*** root rot of pines, one of the most important pathogens of conifer forests in North America. He will explore the distribution and elucidate the biology of ***Heterobasidion irregular***, a new invasive pathogen in Minnesota with the goal of developing biological control strategies. Eric was drawn to Plant Pathology because of his interest in ensuring forest health and the opportunity to work with Dr. Blanchette. Eric is a native of Lester Prairie, Minnesota. Prior to joining the Department, he received a B.S. degree in Forest Resources from the University of Minnesota. He enjoys long distance running, biking, fly-fishing, and foraging for fungi, including his favorite fungus *Laetiporus sulphureus* (chicken of the woods). When he graduates, Eric hopes to have a career in forest health.

Fazal Manan

Fazal Manan is pursuing a M.S. degree advised by **Dr. Brian Steffenson**. His research focuses on developing a Nested Association Mapping Population for genetic dissection of disease resistance and agronomic traits from diverse wheat landraces. Fazal is a native of Bajaur Agency, Pakistan and hopes to one day return to Pakistan and help contribute to the development of sustainable agriculture in his home country and teach young students. Fazal holds a B.S. degree in Agricultural Chemistry from the University of Agriculture Peshawar. He was drawn to Plant Pathology because of the applied and practical nature of the field. Fazal enjoys jogging and playing cricket.

Katarina Sweeney



Kat is a pursuing a Ph.D. degree advised by **Dr. Melania Figueroa** in Plant Pathology and **Dr. Jonathan Schilling** in Bioproducts and Biosystems Engineering. Her research focuses on the mechanisms used by brown rot fungi during wood decomposition, with the aim for their utilization in biofuel production. Kat is a native of Minden, Germany and holds a B.S. degree in Biology from the University of Minnesota and a M.S. degree in Botany and Plant Pathology from Oregon State University. Kat was attracted to Plant Pathology because it allows her to study fungal biology and hopes to one day teach at a university. She enjoys biking, cooking and going on mushroom forays. Her favorite fungi are purple species in the genus ***Cortinarius***.

Degrees Awarded Since 2015

Zane Grabau

Zane completed his M.S. degree in 2013 and Ph.D. degree in 2015 advised by **Dr. Senyu Chen**. Both of his degrees focused on plant parasitic nematodes. His Master's thesis was entitled "Management Strategies for Control of Soybean Cyst Nematode and Their Effect on the Nematode Community," and his Ph.D. dissertation was entitled "Determining the Role of Plant-Parasitic Nematodes in the Crop Rotation Yield Effect, and the Influence Of Crop Rotation and Nematicide Application on the Nematode Community". The focus of his research was investigating management strategies for plant-parasitic nematodes in corn and soybean systems. Some of the strategies investigated include: organic and traditional fertilizers, crop rotation, organic soil amendments, commercial nematicides, and resistant cultivars. He also investigated the impact of these agricultural management practices on soil ecology using the nematode community. Zane is now a postdoctoral research associate with Dr. Haddish Melakeberhan at Michigan State University.

Anna Yang

Anna completed her M.S. degree in 2015 advised by **Dr. Jennifer Juzwik**. Her thesis was entitled, "Detection of the Oak Wilt Pathogen in Sapwood of Northern Oak Species using PCR Technology." Her research entailed using PCR and real-time PCR to improve the current methods for detecting the oak wilt pathogen (*Ceratocystis fagacearum*) in actively wilting as well as dead trees. Currently, Anna is working as a technician for the University of Minnesota Plant Disease Clinic.

Josh Kielsmeier-Cook

Josh completed his M.S. degree in 2015 with a thesis entitled "New Resistance in Old Places: Resistance to the Ug99 Race Group of *Puccinia graminis* f. sp. *tritici* in Wheat Intra/Inter-Generic Hybrids and Historic Germplasm". Josh was advised by **Dr. Matthew Rouse**. His thesis entailed the screening of a large wheat intrageneric and intergeneric hybrid collection for resistance to wheat stem rust. This collection was screened for resistance to virulent stem rust races including those in the Ug99 race group. Accessions with resistance were characterized for their chromosome composition. He also dissected the genetics of resistance to stem rust of a wheat accession from South Africa and introgressed this resistance into adapted germplasm using doubled-haploid methods. Josh is continuing his education in the Department as a Ph.D. student in the laboratory of **Dr. Robert Blanchette**. He is working on the diversity and ecology of the fungal genus *Xylaria* in wet tropical forests of Ecuador.

Peng Zhou

Peng completed his Ph.D. degree in 2015 under advisement of **Dr. Nevin Young**. His dissertation was titled "Defense-Related Gene Families in the Model Legume, *Medicago Truncatula*: Computational Analysis, Pan-Genome Characterization, and Structural Variation." His research entailed the development of a computational pipeline to scan and annotate defense-related genes in plant genomes and analyze the complex structural variation in these gene families, contributing to the construction of a *Medicago* pan-genome. Peng is currently a postdoctoral research associate in Dr. Young's lab. His research focuses on genomic analysis of complex gene families in *Medicago truncatula*. He is interested in the exploration of the genetic architecture of genes and gene families important in plant-microbe interactions and developing informatics tools and resources for discovering members of complex gene families and analyzing their variation in natural populations.

Nick LeBlanc

Nick completed his Ph.D. degree in 2015 with a dissertation entitled "Influence of Plant Diversity and Perennial Plant Identity on *Fusarium* Communities in Soil." Nick was advised by **Dr. Corby Kistler**. His research focused on how changes in plant communities influence the structure, diversity, and function of *Fusarium* communities in soil. By combining metagenomic methods with phenotyping of cultured isolates, his research provided a novel look at a diverse group of fungi found in soils of both agricultural and native ecosystems, which will help refine our understanding of the links between, above and below-ground components of native ecosystems and ultimately will inform the development of strategies for managing microbial communities in agricultural ecosystems. Nick is now working as a postdoctoral research associate with **Dr. Angela Orshinsky** studying fungal diseases of tomatoes.

More Information About Past Plant Pathology Degrees Awarded

For more information about past degrees awarded visit our webpage: https://plpa.cfans.umn.edu/alumni-friends/alumni. Here you will be able to discover all of our graduate's dissertations digitall through the University of MInnesota's Digital Conservency.

St. Paul Annex Northern Research Station, U.S. Forest Service

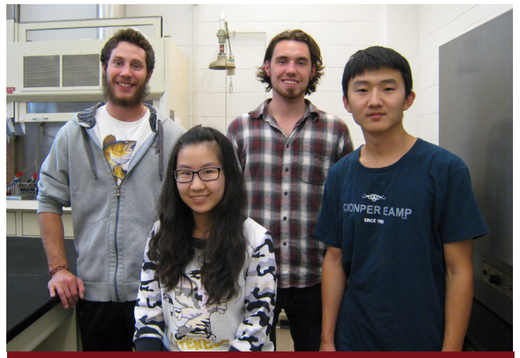
Dr. Rob Venette

The past year has seen major changes for the three research scientists in the St. Paul Annex of the Northern Research Station, U.S. Forest Service. In January, **Dr. Rob Venette** (son of **James Venette**, UM Plant Pathology Ph.D. '75), Research Biologist, became the Director of the Minnesota Invasive Terrestrial Plants and Pests Center at the University of Minnesota. Rob remains a U.S. Forest Service employee, but devotes 50% of his time to his new duties with the University of Minnesota. A similar partnership between the research station and Purdue University developed with the appointment of a Forest Service manager as the Director of the Hardwood Tree Improvement and Regeneration Center (HTIRC) over 15 years ago. **Dr. Jenny Juzwik** has been a member of HTIRC since 2011 and provides forest and shade tree pathology research and development support for the central states. The long anticipated plan for Jenny to relocate to Indiana, however, has not happened due to lack of available laboratory space on the Purdue campus. In spite of that, she has continued with her extensive field work in Indiana and Ohio with much assistance from research collaborators **Dr. Matt Ginzel**, forest entomology professor, and **Jim McKenna**, operational tree breeder, located at Purdue. In May, **Dr. Mike Ostry**, Principal Research Plant Pathologist, retired after a long (> 46 years) and very productive career in forest pathology research. His long-time Biological Technician, **Melanie Moore**, is now providing excellent lab and field support for Jenny's program. Melanie recently published two papers from her M.S. thesis completed in the department.

Minnesota Invasive Terrestrial Plants and Pests Center:
http://www.mitppc.umn.edu/

Northern Research Station, U.S. Forest Service
http://www.nrs.fs.fed.us/

Mycotoxin Lab



Mycotoxin Diagnostic Laboratory undergraduate students Kyle Gustafson, Kaixian Yang, Alec Stewart and Siwei Qian

The Mycotoxin Diagnostic Laboratory continued to provide mycotoxin analysis services for the projects funded by the US Wheat and Barley Scab Initiative (USWBSI) and the Minnesota Small Grain Initiative (SGI) in 2014. In addition, we also helped two local farmers to assess mycotoxin contamination levels for their organically grown wheat and barley this year. From January to December of 2014, our laboratory analyzed 30,199 samples that were submitted by 45 groups from 20 states, including Arkansas, Delaware, Georgia, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, New York, North Carolina, North Dakota, Ohio, South Dakota, Tennessee, and Wisconsin, and one group from the University of Life Sciences in Norway. About 30% of the samples were from projects conducted by Minnesota researchers. Mycotoxin assays were done on large and small (<4 g) mature grain samples, single kernels, single spikelets, single heads, wheat straw, and fungal culture extracts. The target toxins included deoxynivalenol (DON), 15-Acetyl-DON, 3-Acetyl-DON, nivalenol and zearalenone. Quantitative data of ergosterol concentration, a chemical marker for measuring fungal biomass, was also provided. Finally, we performed assays for aflatoxins and fumonisins in 53 corn samples from Somalia submitted by Dr. Paul Porter.

As far as lab personnel, we had four new undergraduate students join our group this fall semester. They are **Kaixian Yang**, **Alec Stewart**, **Siwei Qian** and **Kyle Gustafson**. They are involved in grain sample preparations, which include grinding grain seeds, weighing grain samples, extracting mycotoxins from grain samples and preparing purification columns.

The Cereal Disease Lab

It was a quiet year at the Cereal Disease Laboratory. Everyone was in search of resistance and how to get rid of rust (the evil wizard Gargamel). This search took several scientists (**Drs. Les Szabo**, **Yue Jin** and **Jim Kolmer**) to the 14th International Cereal Rust and Powdery Mildew Conference in

Dr. Yue Jin (right) with his colleague Gordon Cisar (left)

Helsingør, Denmark. The Kronborg Castle in Helsingør is famous as the setting for Shakespeare's play Hamlet. They were invited to give presentations on high-throughput rust genotyping and rust migration patterns worldwide.

During this visit to Denmark, Dr. Szabo visited the fungal herbarium at the University of Copenhagen, hosted by Henning Knudsen, in search of *Puccinia graminis* f. sp. *tritici* collections from the 1800's. The visit ended with a two-day visit to the Aarhus University experiment station in Fladdebjerg hosted by Mogens Hovmøller.

Dr. Kolmer was also invited as a keynote speaker at the 3rd Conference of Cereal Biotechnology and Breeding in Berlin, Germany in November. His presentation was on "Virulence dynamics and genetic variation in *Puccinia triticina* and approaches for durable leaf rust resistance in wheat", which was well received by the audience.

Over 10 years ago Dr. Norman Borlaug sounded the alarm that African races of the stem rust pathogen (especially race TTKSK, aka isolate Ug99) have the potential to impact the world's wheat supply. Since that time, scientists at the USDA-ARS Cereal Disease Lab have screened hundreds of thousands of wheat lines with race TTKSK in order to identify new sources of resistance. However, recent developments have changed the dynamics of the fight against Ug99 lineage races like TTKSK. First, Dr. Yue Jin and colleagues discovered new variants of Ug99 lineage races that are virulent to the resistance gene *SrTmp*. Virulence to *SrTmp* was thought to have been selected for because a wheat variety with the *SrTmp* gene was widely deployed in Kenya over the past few years. This finding makes the Ug99 lineage races even more threatening to the United States because several wheat cultivars in the south possess this resistance gene. Second, the TTKSK-resistant wheat cultivar Linkert, released by the University of Minnesota in 2013, was planted over 13% of the wheat acreage in Minnesota in 2015. Linkert is characterized as seedling susceptible to race TTKSK, but resistant at the adult plant stage. The availability of a TTKSK-resistant wheat cultivar planted over this scale in an area of the United States historically most vulnerable to stem rust epidemics is a major achievement. However, as the evil wizard Gargamel is shifty and changes constantly, scientists at the Cereal Disease Lab continue their search on how to defeat him.

In addition to rust, scientists at Cereal Disease Lab also work on *Fusarium* the causal agent of *Fusarium* Head Blight or scab of wheat and barley. The Kistler lab has started a new research project identifying symptomless hosts of *Fusarium* species in native grasslands. The effort has driven collection trips for *Fusarium* isolates in over 20 Minnesota State Parks during the summer of 2015 by biological technicians, **Amanda Certano** and **Kat LaBine**. So far, more than 1,000 cultures of *Fusarium* have been collected from at least ten symptomless grass species. This effort will increase our understanding of this fungal species and how it changes to become a devastating disease.

So it was a quiet year at the Cereal Disease Laboratory, where all the scientists were busy searching for how wheat, barley and oat pathogens move, change and evolve and find solutions to combat their devastating impact.

Visit the CDL Online:

http://www.ars.usda.gov/main/site_main.htm?modecode=50-62-05-00

The Plant Disease Clinic

It has been a very active year at the Plant Disease Clinic (PDC). From October 1, 2014 to September 30, 2015, customers submitted 1,867 samples. This represented a 20% increase compared to a similar time period in the previous year--which also seemed busy! The August through September period was particularly brisk compared to recent years, perhaps reflecting a more humid weather pattern than was observed in more recent years. This relatively consistent precipitation pattern appeared to be particularly conducive to the various anthracnose diseases.

Jennifer Flynn took advantage of two diagnostic workshops offered and paid for by the National Plant Disease Diagnostic Network (NPDN) in March in Beltsville MD. One workshop featured diagnostic techniques for phytoplasma detection, and the other featured *Phytophthora*. The latter was taught by **John Bienapfl**, a 2011 graduate of the department, now working for USDA-APHIS in Maryland. Jennifer was also able to visit with the previous PDC director, **Dimitre Mollov**. Dimitre has been working for the USDA in Beltsville as a research scientist specializing in viral diagnostics since 2013.

During the previous year, three undergraduate CFANS students have worked at the PDC, primarily assisting with preparation of diagnostic tests. **Grace Prins**, **Betni Nyquist**, and **Liam Genter** all provided excellent support for the PDC mission during this time. In addition, 2015 department graduate, **Anna Yang** has been working as a temp/casual employee at the PDC since September. As her completed thesis work was on oak wilt molecular diagnostics, she has provided excellent help in dealing with these commonly submitted, but labor intensive samples.

Samples representing more than 140 different host species were submitted to the PDC in the last year. Of these, corn for grain mold testing was the single most commonly submitted sample with over 850 submissions. Most of this testing takes place over the winter months, which is a fortunate complement to the busy summer period. The second most common sample type was the oaks as a group with over 130 submissions. Oak wilt testing was the biggest reason for submission. Spruce samples were also very common with over 80 submissions. The Colorado blue spruce, which is not native to Minnesota but used as a popular landscape planting, suffers from a variety of fungal and insect problems.

Anthracnose symptoms in Maple.

Have you ever wondered why the first floor of Stakman Hall sometimes smells like an Italian restaurant? The answer is that we also received over 50 garlic plants for testing, typically in search of the garlic bloat nematode, *Ditylenchus dipsaci.* With respect to field crops, corn was the most common plant submitted for disease diagnosis with 50 samples. The main disease concern was Goss's wilt, but toward the end of the summer many samples with northern corn leaf blight also were processed. **Dr. Ben Lockhart** was kept busy with viral testing of spirea samples: almost 40 samples were submitted, both within and outside the state. Many of these samples also required testing for the spirea stunt phytoplasma disease. Other common sample types submitted to the PDC in the last 12 months were tomato (45), pine (30), soybean (27) and hydrangea (19).

The Plant Disease Clinic

Visit the PDC's Webpage

pdc.umn.edu

Plant Pathology APS Meeting Roundup

The annual meeting of the American Phytopathological Society (APS) was held in Pasadena, CA this year (July 31 to August 5). Attended by approximately 1,500 plant pathologists, the meeting included numerous workshops, field trips, and training and networking opportunities, in addition to scientific talks and posters. In total, 26 Plant Pathology faculty, postdocs, staff, and students authored or co-authored posters or gave oral presentations at this meeting. For this meeting, the record for most posters and oral presentations authored/co-authored goes to Professor **Dean Malvick**, co-author on four posters and one oral presentation. As Chair of the APS Committee for Diversity and Equality, Professor **Jim Bradeen** led the annual Diversity and Equality Workshop exploring strategies to further careers for all plant pathologists. Plant Pathology also hosted an alumni social attended by dozens of friends and alums from around the world. This was an opportunity to provide a sneak peak of the soon-to-be released Living Legacy project by bringing piles of pictures of Department life from years gone past. This year Professor **Carol Ishimaru** was named APS Fellow for excellence in administration and service. APS Fellow is the highest distinction offered by the Society.

From left to right: Matt Snelham with Carol, Nick and Dan Ishimaru at the APS Meeting.


UMN Plant Pathology members at the NCAPS meeting in East Lansing, MI

NCAPS Meeting Recap

The Department of Plant Pathology had a strong showing at the North Central American Phytopathological Society (NCAPS) meeting in East Lansing, MI on June 11-12. Professor **Angela Orshinsky** organized a caravan to drive to the meeting, facilitating participation of several students and staff. Graduate Student **Blake Webster** and undergraduate student **Marissa Scherven** received NCAPS Travel Awards to support their participation in the meeting and both presented research posters. Graduate Student **Josh Havill** attended the meeting with support from the Ward C. Steinstra and Richard A. Meronuck Graduate Student Travel Award. Postdoc **Ryan McNally** and Research Fellow **Crystal Floyd** both presented research posters. Professors **Yue Jin** and **Linda Kinkel** presented invited keynote addresses on the first day of the meeting and Professor **Dean Malvick** presented an invited talk as part of a mini-symposium on Goss' Wilt in Corn on the second day of the meeting. Other Departmental participants included **Grace Anderson**, **Jim Bradeen**, **Ashok Chanda**, **Lillian Garber**, **Kurt Hockemeyer**, and **Carol Ishimaru**.

Next year the University of Minnesota will host NCAPS at the Landscape Arboretum. Professor Angela Orshinsky assumed the regional presidency in East Lansing and she and her committee have great plans for next year's meeting.


Ruth Dill-Macky working with Ethiopian trainees in Kulumsa, Ethiopia

Training Wheat Farmers in Ethiopia

Ruth Dill-Macky and **Pablo Olivera** headed to Ethiopia in October. Along with David Hodson (CIMMYT) and senior scientists at the Ethiopian Institute of Agricultural Research (EIAR), they helped run a week-long training for 25 early career plant pathologists and plant breeders with EIAR and stationed at the fourteen federal research centers run by EIAR throughout Ethiopia. The training was held at the Kulumsa Agricultural Research Center about 170 km southeast of Addis Ababa. The week was rich in discussions of the challenges facing Ethiopian wheat production and hands on activities aimed at developing research skills in the laboratory, greenhouse and field.

A Come From Behind Victory for the Students in the 42nd Annual Stakman Softball Game

The 2015 Stakman Softball game was held this year on a rainy and humid day; however the rain held off long enough to allow seven innings of great play from both teams. Despite new additions to the faculty and staff team, the students prevailed, rallying behind 4 runs in the bottom of the seventh to defeat the faculty/staff team on a walk-off single by **Blake Webster** that found its way into left field.

The faculty/staff started the game out strong capturing the early lead behind strong hitting performances from **Kurt Hockemeyer** who had six hits and **Brett Arenz** who had five. **Corby Kistler** was the workhorse on the mound for the faculty/staff pitching with great efficiency in the first few innings, retiring the students quickly behind solid defense and infield play. Despite racking up many hits throughout the early portion of the game, the faculty/staff made a few timely mistakes on the base paths and left numerous runners on base in scoring position.

The students began to capitalize on these missed opportunities, and in the latter innings of the game the students began chipping away at the lead as a result of a few errors made by the faculty/staff. Rallying around a fifth inning homerun by **Sean O'Mare** (PhD advisee of **Corby Kistler** in the Department of Plant Biology) and sixth inning triple by **Kyle Haralson**, the students pulled within three runs going into the bottom of the seventh inning. The final inning rally was lead by a triple from **Derek Camitsch** and an RBI double by **Garrett Beier**. The students tallied 4 runs in this inning leading to the victory while the defense did not record a single out.

After the game students, faculty, and staff enjoyed delicious hot dogs, cracker jacks, and other ballpark classics. This year's victory means two straight victories for the students, and next year the faculty will look to redeem their previous reign during the 42nd Annual Stakman Softball Game.

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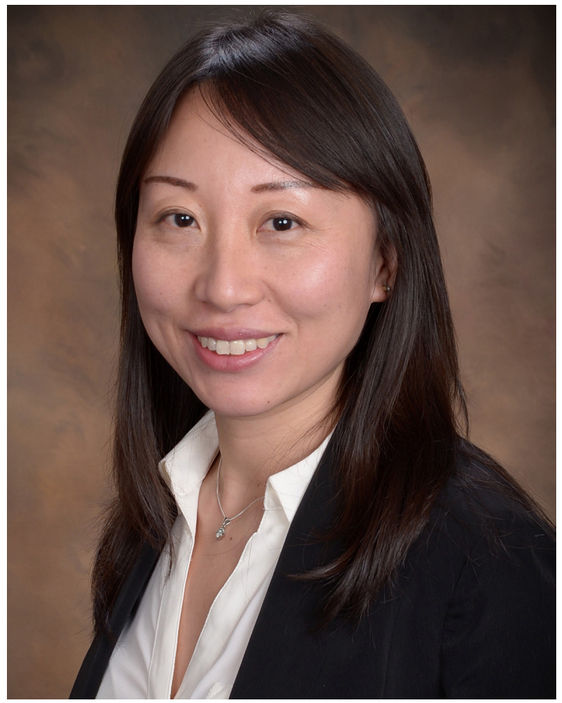
Question & Alumni

As Variety Creation Lead in the Agro Discovery & Sustainability team at PepsiCo, **Haiyan Jia (2005 M.S.)** leads the development of advanced breeding technologies to accelerate the improvement of agro raw materials concurrently improved for productivity, processing ability, and consumer preference and benefit.



What is your passion? What do you love about your work and your field?
My passion is to apply my knowledge and experience to research and product development in agriculture/crop science. My current role spans across different crops: from oat, potato to corn and citrus, etc. My work impacts the agro raw materials that make many household name products such as Quaker Oats, Fritos, Lay's and Doritos chips, and Tropicana juices. I am so proud that my work can create healthy, nutritious and fun food and beverage products for people around the globe.

Why did you get involved with Plant Pathology at the University of Minnesota?
I heard a lot about the department during my undergraduate experience in China. I was awarded the first Wang Huanru Fellowship for outstanding performance at the Agricultural University of Hebei. Professor Wang conducted wheat stem rust research with E.C. Stakman in 1945 at UMN and became one of the pioneers for China's wheat rust research. My former advisor, Dr. Daqun Liu, obtained his PhD from the department. In 2000, I met the former department head Dr. Frank Pfleger in China when he visited my former university with a delegation of UMN professors.

What's great about the Department of Plant Pathology?
The world-renowned legacy of the department and the global impact the department and its alumni have created. I had the honor to meet Dr. Norman Borlaug twice on campus and had memorable conversations with him.

How did your education at the U of M help prepare you for what you are doing today?
In addition to excellent mentors, the department offers a well-designed curriculum, high-quality courses, plus unique internship opportunities. Thanks to the department for making my graduate experience so meaningful and enjoyable.

What advice do you have for current students (and future alumni)?
Keep an open mind about your career. Always think about how your work/research can make an applicable impact in the real-world.

Question & Alumni

As Professor and Head of the Department of Plant Protection at the National School of Agriculture in Meknes, Morocco, **Mohammed Boulif (1986 PhD)** teaches the next generation of plant pathologists integrated disease management strategies to help them work with farmers to improve growing practices using sound scientific knowledge and field research results.

What's great about the Department of Plant Pathology?
I have appreciated the rigorous organization of Plant Pathology and the friendly relationships among the members of the Department: faculty, staff and students. When I first came to Plant Pathology as a youngster of 22 years of age in the fall of 1973, I was assigned to the same office as older PhD candidates Bob Crow and Ben Skovmand. For me it was a unique growing environment. I was impressed by the laboratory and greenhouse spaces which I saw for the first time in my life. The most enriching experience was the Plant Disease Clinic where I took turns with other graduate students to answer phone calls, and diagnose diseased plant samples sent by mail or brought in by clients. Working in the Plant Disease Clinic was excellent for my self-confidence, since I was a young Moroccan helping American citizens who were seeking advice about their sick crops and diseased household plants.

How did your education at the U of M help prepare you for what you are doing today?
The different courses that I have taken in the Department of Plant Pathology on one hand and the Department of Agronomy and Plant Genetics on the other hand, prepared me very well for my teaching career in Morocco. Acquiring the skill of reading and having top-level scientific knowledge in the language of Shakespeare was an additional blessing. Gaining those skills have helped me a lot in perfecting my courses and keeping up to date with new knowledge throughout the world. The pragmatic approach of doing research and the way the courses are taught at the University of Minnesota had great influence on my way of doing things since my graduation.

What advice do you have for current students (and future alumni)?
Whatever your specialty in plant pathology is, try to back up your vertical strength in plant pathology by adding other disciplines to your curriculum such as entomology, weed science, agronomy, horticulture and basic economics. Also, studying at the University of Minnesota is great, but moving around the world can be very enriching for growing students.

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Collaborating with MDA to Solve Plant Disease Problems

For Plant Pathology Alumna **Kathy Kromroy** (M.S. 1982, Ph.D. 1999), her work as a Research Plant Pathologist in the plant protection unit of the Minnesota Department of Agriculture extends far beyond conducting research on the different crop groups and pathogens prevalent throughout Minnesota. Kromroy has fostered an inter-institutional relationship between the Department of Plant Pathology, other University partners (University of Minnesota Extension and the Plant Disease Clinic) and the MDA, generating new collaborations that solve plant disease problems across the state.

Kromroy has worked with extension educators, researchers and diagnosticians at the University of Minnesota to survey for invasive pathogens and educate the public about how to identify and respond to emerging disease issues. Kromroy is also a key member of the First Detector program teaching volunteers how to identify invasive forest pests and pathogens in Minnesota.

As a result of Kromroy's efforts to share information with Plant Pathology, work with stakeholders in a collaborative manner, and assess concerns about emerging and invasive diseases, she was awarded Plant Pathology's Distinguished Alumnus Award in 2015.

New Hires

José Pablo Dundore-Arias

José obtained a Ph.D. in Plant Pathology from the University of Wisconsin–Madison. Recognized as a leader in his field, his awards and honors include the APS Mathre Educational Award, CCGA-Future Global Agricultural Leader, and the PCGFS/USAID Borlaug Fellowship in Global Food Security. He currently serves as an early career intern for the APS Public Policy Board and is actively involved in the Phytobiomes Initiative. José is using his broad interdisciplinary background in his work as a research associate with Professor **Linda Kinkel**, investigating the potential of beneficial microbes to increase both plant health and productivity. He is originally from San Jose, Costa Rica, and enjoys spending time with his photographer husband and their dog. He also enjoys an active lifestyle. Of the six marathons he has so far completed, the 2015 Twin Cities Marathon was his favorite.

Nick LeBlanc

Nick completed his Ph.D. under the guidance of Professor **H. Corby Kistler,** studying the dynamic interactions between plant and fungal communities in the soil. In October 2015, he started a position as a postdoctoral associate in the lab of Assistant Professor **Angela Orshinsky**. His new project focuses on the biology of ***Passalora fulva***, the causal agent of tomato leaf mold and a particular concern for high tunnel growers in Minnesota. Nick is originally from Silver Spring, Maryland, and adores hiking in Minnesota's beautiful landscapes, particularly the prairies. When not hard at work or cooking soup, he can be found outside, studying the ground (as a keen mycologist), or studying the sky (as an avid nephologist).

Liana Nice

A newly-minted Ph.D. from the University of Minnesota Applied Plant Sciences Graduate Program, Liana developed a genetically diverse wild barley introgression population for the barley breeding program, advised by Professor **Gary Muehlbauer.** Her current research as a postdoctoral associate in Professor **Nevin Young's** laboratory analyzes a retrospective panel of University of Minnesota soybean breeding and founder lines for tolerance and partial resistance to various root diseases, including ***Phytophthora sojae***, ***Fusarium graminearum***, and the soybean cyst nematode. This project is a collaborative effort, pulling expertise from several CFANS faculty members, including **Nevin Young**, **Jim Kurle** and **Senyu Chen** from the Department of Plant Pathology, and **Jim Orf** and **Aaron Lorenz** from the Department of Agronomy and Plant Genetics. Liana is from Frederick, Maryland, and became interested in plant breeding while working for the wheat breeding program at her ***alma mater***, Cornell University. Living and working in Minnesota allows her to pursue her passion for hockey and skating: Liana has participated in several inline skating marathons.

Peter Samuels

Peter has been working in the Small Grains Pathology Laboratory of Professor **Ruth Dill-Macky** for two years now, but officially became a junior scientist in August 2015. He is involved in a multi-year project, surveying the ***Fusarium*** species that cause crown rot disease of wheat across the state of Minnesota. He is also responsible for species identification in a number of other projects, and provides essential support for many of the field and greenhouse studies conducted by his research group. Originally from Concord, New Hampshire, Peter graduated from Carleton College with a B.A. in Biology. He enjoys Minnesota's great Nordic skiing community and state parks system, but tells us that listing all of the reasons he loves Minnesota would take up an entire issue of ***Aurora Sporealis***!

NEW HIRES

Dylan VanBoxtel

Since April 2015, Dylan is the new communications and relations coordinator for the Department of Plant Pathology and the Stakman–Borlaug Center for Sustainable Plant Health. His multi-faceted role involves communications efforts for both the Department and the SBC. This spans everything from photo shoots and producing videos and promotional flyers, to maintaining our online presence via websites, eNews and social media. Dylan is also responsible for alumni and donor relations, and even provides graduate student support! He hails from Seymour, Wisconsin, and holds a B.S. from the University of Minnesota in Applied Plant Science with an emphasis on Agronomy. Dylan loves art as much as he loves sports. When not creating videos for the Department, he works with a group of friends to create short films and documentaries.

Nik Prenevost

Nik started as the new Assistant Quarantine Officer in May 2015. Nik comes from **Dr. Yue Jin**'s project at the USDA-ARS Cereal Disease Lab, where he worked on stem rust of wheat inside the BSL-3 facility, which he now helps to manage. He graduated with a B.S. degree in Organic Horticulture from the University of Minnesota in 2013. Nik co-owns a start-up company called Mississippi Mushrooms that produces gourmet, exotic mushrooms for the Twin Cities market. He loves anything that involves the outdoors and is excited to forage for morels this year as well as other seasonal mushrooms throughout the summer. You will probably see him biking or long-boarding on campus as he likes to move quickly from place to place and stay connected with all of the professors, fellow scientists and students he has met as an undergraduate, USDA researcher, and now Assistant Quarantine Officer. Nik has an amazing energetic passion for the research that goes on at the university and will be a great asset to the BSL-3 facility and its users.

Sarah Castle

Sarah obtained a Ph.D. in Forestry from the University of Montana where her research explored the importance of soil biodiversity in regulating ecosystem processes. At retreating glaciers across the Western Hemisphere, she investigated how microbial communities undergo successional shifts as glaciers retreat from the landscape. In March 2015, Sarah joined the labs of **Drs. Linda Kinkel** and **Deborah Samac** as a Postdoctoral Research Associate and works with the University of Minnesota's Long-term Agricultural Research Network. At the University of Minnesota she is investigating how crop rotational diversity and management influence the composition and function of soil organisms, and in turn, how soil organisms feedback to influence the quantity and quality of crop production. Sarah is originally from the small mountain town of Georgetown, Colorado. When away from the office, Sarah enjoys biking, trail running, and traveling. She looks forward to learning how to skate ski this winter.

Peng Zhou

Hailing from Chaohu, a small city in southeast China, Peng completed his Ph.D. right here at the University of Minnesota, developing informatics tools for studying the genome of the model legume, ***Medicago truncatula***. Since July 2015, he has continued this research as a postdoctoral associate in the laboratory of Professor **Nevin Young.** As part of his innovative computational biology work, he is interested in harnessing next-generation sequencing data from ***Medicago*** to describe the genetic architecture of genes and gene families important in plant–microbe interactions, as well as to explore the variation in complex gene families across natural populations. In his spare time, Peng enjoys keeping fit,

Chana Johnston

Chana joined the Department of Plant Pathology in March, 2015, as the Administrative Support Specialist. In addition to coordinating special departmental projects and assisting Plant Pathology Faculty, she also provides administrative support for the Stakman–Borlaug Center. Prior to joining Plant Pathology, she worked in the Department of Family Social Science while completing an undergraduate degree in Spanish and Global Studies at the University of Minnesota. Chana is a native of rural western Wisconsin, enjoys home-improvement projects, and loves adventuring and exploring to find the best hiking, burgers and shopping. Chana and her husband recently purchased some acreage just across the border in Wisconsin that they are excited to cultivate and raise a family on.

Susan Rottschaefer

Susan is a new junior scientist in the laboratory of Assistant Professor **Melania Figueroa**, assessing genetic diversity in the populations of two important fungal pathogens of oats: crown rust (***Puccinia coronata* f. sp. *avenae***) and loose smut (***Ustilago avenae***). A Minnesota native, she obtained a B.S. in Biology from the University of Puget Sound and an M.S. in Entomology from Cornell University. After studying the evolutionary genetics of insect–pathogen interactions as a research technician at Cornell, Susan answered the call of her beloved hometown, and is currently enjoying getting reacquainted with her beloved Twin Cities.

Ahmad Sallam

Ahmad is a new postdoctoral research associate in the Steffenson Laboratory. His main research project focuses on the genetic diversity of wild barley for economically important traits. Specificallly, Ahmad is using cutting edge molecular marker data to map genes for disease resistance across the genome, including those effective against the widely virulent strains of African stem rust (***Puccinia graminis f. sp. tritici***). He came to Minnesota from Cairo, Egypt (by way of Phoenix, Arizona), and completed a B.S. degree in Crop Science and M.S. and Ph.D degrees in Plant Breeding from the Department of Agronomy and Plant Genetics at the University of Minnesota. When not occupied in the lab with cereal genomics, Ahmad enjoys playing soccer and reading history books.

Jitendra Kumar

Jitendra is a postdoctoral associate in the Department of Plant Pathology and the USDA-ARS Cereal Disease Laboratory, working with Professor **Ruth Dill-Macky** and Professor **Shahryar Kianian**. During his Ph.D. research, he discovered a novel mastrevirus, as well as the first geminivirus known to infect both monocot and dicot plants. Jitendra has been highly awarded in his native India, receiving the NASI-Young Scientist Platinum Jubilee Award, the DST-Fast Track Young Scientist Research Grant, and several other competitive fellowships. Currently, he is exploring the mechanism of Fusarium head blight (FHB) tolerance in durum wheat, with an emphasis on how DNA methylation patterns affect expression of FHB resistance. These and other research questions related to FHB resistance in durum wheat allows him to conduct experiments in the growth chamber, greenhouse and field. Jitendra and his wife are excited for their six month-old daughter to experience her first snowy Minnesota winter.

Stakman Table of Diseases and Delights

Cedar Apple Rust Pathogen, *Gymnosporangium juniperi-virginianae*

Morel Mushrooms

Golden Jelly Fungus, *Tremella mesenterica*

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We need private support now more than ever. Public support for higher education, on a per capita basis, has been dropping for 30 years. In fact, in the 1990s the University of Minnesota received 33% of its revenue from the State of Minnesota. Now, the State contributes less than 19%. Other land grant institutions have experienced even lower state support. It is the generosity of our donors that has enabled the continued pursuit of excellence and expanded opportunities for students.

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Questions - If you have any questions related to giving, please contact Shana Zaiser at zais0003@umn.edu or 612-626-3045.

The Borlaug 100 Campaign

Fully Funding the Norman E. Borlaug Fellowship for International Agriculture

On March 25, 2014, we celebrated the 100th anniversary of the birth of Norman Ernest Borlaug, Department of Plant Pathology alumnus, Nobel Peace Prize Laureate, and one of the greatest humanitarians who ever lived.

The Department and the University are so very proud to have produced a scientist like Borlaug. To establish a proper legacy to this great man, a number of new initiatives have been made in the Department, foremost of which is the new Stakman-Borlaug Center. But did you know that Borlaug’s graduate education may never have happened if it weren’t for the timely intervention of E. C. Stakman? One of Borlaug’s first encounters with E. C. Stakman was when he attended a Sigma Xi lecture given by the pre-eminent plant pathologist in late 1937. Borlaug sat spell-bound as Professor Stakman delivered a dynamic lecture about the cereal rusts. Upon arriving home, he told his wife Margaret that Professor Stakman “lit up the skies that night” with his lecture.

Borlaug was set to graduate with his B.S. degree in forestry in December of that year and had received the good news of a forestry position in Idaho. It was in the west where he and his new bride Margaret would start their life together. But then, as is the case now, budget cuts hit the Forest Service and Borlaug’s position was rescinded.

Desperate for a job and money to support his new bride, Borlaug had no idea what to do. Margaret suggested he speak with that professor who gave the inspirational lecture. He followed through on Margaret’s advice and told Professor Stakman that he would like to pursue graduate studies “for awhile” until news of the forestry position being reinstated would come. Stakman admonished Borlaug about not conducting research “in dribs and drabs” and to be focused on graduate studies. In the end, Stakman gave Borlaug a chance and offered him an assistantship, which kept the newly wedded couple from descending into dire poverty—this being the depth of the Great Depression. The graduate assistantship provided by Stakman to Borlaug at this critical juncture saved a family, a career, and one might even say a significant part of humanity given the impact of Borlaug’s Green Revolution wheats in averting mass starvation of people in South Asia.

It was Borlaug’s research and humanitarian efforts that drove me to pursue an advanced degree in Plant Pathology. I am so honored now to be back in the Department of Plant Pathology as a Professor and the Lieberman-Okinow Chair. I never thought I would have the chance to really rub elbows with this great man other than a perfunctory greeting and handshake when he came to deliver an occasional lecture. However, the “shifty enemy” (stem rust) raised its ugly head again in 1999 in the form of a new highly virulent race called TTKSK (or isolate “Ug99”). Race TTKSK is highly virulent on the Green Revolution wheats Borlaug bred years ago. Knowing the threat that race TTKSK posed to a large share of the world’s wheats, Borlaug sprung into action to warn the scientific community of this imminent new threat. A group

of U.S. scientists was assembled in St. Paul to plan the strategy for combatting this new rust race, and I was privileged to be among them and work with Borlaug.

Borlaug loved the Department and University and visited the campus often. After interacting with him at the stem rust strategy meeting, I began to think about how we could further honor his great legacy at the University, aside from the namesake building and lecture series that were already in place. In 2004, I thought of establishing a graduate fellowship in Borlaug’s name at his beloved alma mater. This seemed fitting since the funds would support young scientists who would be actively engaged in research to help alleviate hunger. Moreover, it was by this type of support mechanism that Stakman was able to provide funding to a young Borlaug, enabling him to pursue his graduate degrees and continue what became an illustrious and productive career.

I spoke with Dr. Borlaug about my idea. He was delighted at the plan and gave his wholehearted support for it. Thus, the Norman E. Borlaug Fellowship for International Agriculture was officially launched in the Department in late 2006 with a donation from my wife

(Winnie) and me. A generous donation by alumnus Markus Andres (Ph.D. ’83) and his wife Hedi put the endowment for this Fellowship over a critical funding threshold, making it eligible for matching dollars through the 21st Century Fund from the Graduate School of the University of Minnesota. The 21st Century Fund matches on a dollar-for-dollar basis the payout of the Borlaug Fellowship Endowment, essentially doubling the “buying power” of a donation.

We would like to honor this man’s great legacy by fully funding the endowment for support of the Norman E. Borlaug Fellowship for International Agriculture (#1445). Our goal is to raise $1 million for this Endowment, which will provide, in perpetuity, the financial support for the best and brightest graduate students, one female and one male, to continue the great works done by Dr. Borlaug. I sincerely hope you will consider donating to this most worthy cause in 2015.

Respectively, Brian Steffenson (B.S. ’80, M.S. ’83)

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Our students and department members would like to thank previous donors for making it possible for students to conduct their research, travel to meetings to present their research, and support other scholarly activities reported in this issue of the *Aurora Sporealis*.

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We remain global leaders in plant pathology today and continue to adapt our research, teaching, and Extension efforts to respond to contemporary needs and opportunities. While institutional support and research grants from public and private entities remain critical to work we do, contributions from donors play an increasingly important role in helping the Department remain an agile, adaptable, and highly effective world leader. Your dollars, time, and advocacy support our research, teaching, and Extension mission, helping us delve into new fields of science, expand education and outreach programs, update facilities, and provide contemporary training opportunities for our students. We are grateful for your support and look forward to meeting and exceeding your expectations!

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